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Pollution Prevention Opportunity Assessment for Sandia National Laboratories/California Recycling Programs

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Prepared by
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Pollution Prevention Opportunity Assessment for Sandia National Laboratories/California – Feasibility of Centralized Recycling Facility

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Abstract

This Pollution Prevention Opportunity Assessment (PPOA) was conducted for the Sandia National Laboratories/California (SNL/CA) Environmental Management Department between May 2006 and March 2007, to evaluate the current site-wide recycling program for potential opportunities to improve the efficiency of the program. This report contains a summary of the information collected and analyses performed with recommended options for implementation. The SNL/NM Pollution Prevention (P2) staff worked with the SNL/CA P2 Staff to arrive at these options.

Acknowledgements

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Acronyms and Abbreviations

C&D	Construction & Demolition
CRV	California Refund Value
EMS	Environmental Management System
FY	Fiscal Year
IDT	Interdisciplinary Team
LLNL	Lawrence Livermore National Laboratory
MOU	Memorandum of Understanding
mt	Metric Tons
P2	Pollution Prevention
PPOA	Pollution Prevention Opportunity Assessment
RCRA	Resource Conservation and Recovery Act
ROI	Return on Investment
SNL/CA	Sandia National Laboratories/California
SNL/NM	Sandia National Laboratories/New Mexico
TAG	Test Assembly Group
WM	Waste Management, Inc

Executive Summary

This PPOA was conducted for the SNL/CA Environmental Management Department between May 2006 and March 2007, to evaluate the current recycling program for potential opportunities to improve the effectiveness and efficiency of the program. In its Environmental Management System (EMS), SNL/CA set an objective to minimize the quantity of waste sent to the landfill, by a combination of reduced consumption and increasing reuse and recycling, and to investigate the feasibility of a centrally located solid waste sorting and collection facility.

The SNL/CA recycling operations are led by three P2 staff: the P2 Program leader, the P2 Project leader, and the P2 laborer, and supported by staff in the Maintenance Engineering Department. The Recycling Program annual costs are estimated to be $100,000.

In FY05, the site generated approximately 611 metric tons (mt) of routine solid waste, of which 165 mt was landfilled, and the remaining 446 mt were recycled, either directly or indirectly (via LLNL). In FY06, the site generated approximately 514 mt of routine solid waste, of which 160 mt was landfilled, and the remaining 354 mt were recycled. The routine recycling rate in FY06 was 69%, and 73% in FY05. Revenues from recycling are limited and are not currently earmarked for improvements to the recycling program.

The primary motivation for this PPOA was to examine the feasibility of establishing a recycle center, to improve the recycling infrastructure and improve recycling program efficiency. However, the investigation that followed covers all aspects of the recycling operation and has been guided by consideration of the following four options:

1. Continue the present recycling process and operations, with minor modifications and refinements.
2. Implement specific high priority improvements to the existing recycling process and operations.
3. Implement a basic recycling center to consolidate and improve existing recycling operations.
4. Implement a recycling center with associated equipment to attract best-value material recycling vendors and optimize potential revenue for all high impact recyclable waste streams.

The goals for the PPOA are in the following priority:

1. Improve efficiency of recycling operations
2. Reduce maintenance costs associated with recycling
3. Possibly increase revenues from recycling
4. Increase the number of waste/recycling streams managed
5. Improve collaboration with LLNL to the benefit of both entities.

The options and their associated opportunities are described and analyzed in Section 5 and a summary of the opportunities is presented below:

Option 1 involves minor modifications and refinements of the existing recycling program to improve the efficiency of collection and/or improve recycling rates for currently recycled waste streams. These minor modifications are considered to be low cost opportunities ("best buys first") and can be implemented with primarily internal P2 support. The opportunities identified for Option 1 include:

Opportunity	Description	Cost
1-a	Develop recycling procedure to improve collection, tracking and reporting	Low
1-b	Install signage on bins to clearly indicate acceptable and non-acceptable materials	Low
1-c	Stage additional scrap metal and wood bins	Low
1-d	Periodically compact wood pallets in roll-off	Low
1-e	Awareness campaign for cardboard to raise recycling level	Low
1-f	Additional awareness campaigns for wood & metal	Low
1-g	Develop procedure on excess material inventory to make it "first choice". If not, collaborate with LLNL or auction.	Low

Option 2 builds on the opportunities described for Option 1, by implementing a number of high priority improvements: High priority is defined as those improvements which have the highest potential for increasing efficiency of recycling operations. The high priority improvements are focused on landscape debris, scrap metal and electronic waste and include:

Opportunity	Description	Cost
2-a	Micro-mulch grass clippings on turf for multiple benefits	$2000
2-b	Chip/shred tree trimmings on non-turf permeable surfaces. Obtain chipper from LLNL.	Low
2-c	Contract with scrap metal recyclers for monthly revenue	Net revenue
2-d	Contract with electronic waste recyclers for pickup of computer monitors & other office e-waste	Cost neutral or better
2-e	Recycling other e-waste, e.g., lab test equipment and IC boards	Net revenue

Option 3 establishes a basic recycling center for existing operations and meets all the goals established for this PPOA. The basic recycling center is intended to consolidate the accumulation and management of recyclable materials to a single location, to the extent practical. Certain materials would continue to be managed as currently practiced, such as green (landscaping) debris, furniture, computer and electronic equipment, and scrap metal. The specific activities performed to accumulate and prepare these materials for recycling were determined to not easily be relocated and therefore should remain as-is. However, recycling of cardboard, plastic, aluminum cans, glass, scrap wood and pallets, and concrete would be conducted at the recycling center.

Another aspect of Option 3 is the utilization of a single source recycling vendor to service the recycling center. The single source recycling vendor would provide all transportation and recycling services, and report recycled quantity results to the P2 program. The major benefits of

the single-source recycling vendor are to simplify the contractual aspects of the recycling program, establish a single point of contact for recycling services, and provide opportunity to easily add new materials for recycling.

The preferred site for the basic recycle center (Site B) is outside the limited area fence, near Post 15 and east of Bldg 928. Limited site development is required as no site utilities are necessary. The annual cost for services of a single source recycling vendor is based on the quantities of materials generated and the number of hauls required.

Option 4 is similar to Option 3, except that recycling services for each different material are provided by a best-value material recycling vendor rather than a single source recycling service vendor. Option 4 also establishes a recycling center (same site as preferred for Option 3) and includes equipment to ensure high value revenue potential for materials. The Option 4 recycling center also contains spatial allowances for accumulation of materials that allow higher revenue value, including cardboard and reusable wood pallets. Option 4 seeks to maximize potential revenue value for recyclables as a means of paying for implementation costs as well as a funding source for future recycling activities and initiatives.

The estimated cost to establish the Option 4 recycle center is $24K plus site preparation costs. Annual cost for services and operation of the recycling center is estimated to be $34.5K. Option 4 is estimated to generate $40-$100,000 in annual recycling revenue.

This PPOA recommends implementation of the options described herein on a phased approach that seeks first to streamline current operations and reduce costs, then maximizes revenue potential for existing recycle streams to ultimately expand to a recycling center near Post 15. A recycling center is considered to provide the best opportunity to increase the types and quantities of materials recycled. A potential timetable has been established for implementation of Options 1 & 2, and elements of Option 3, setting the stage for implementation of Option 4.

1. Introduction

Sandia National Laboratories (SNL) conducts pollution prevention opportunity assessments (PPOAs) for line organizations to evaluate waste-generating processes and identify cost-effective methods to reduce waste. The completed PPOA is presented to the line organization for consideration and implementation. The goal of a typical PPOA is to:

- Reduce waste volumes and toxicity
- Implement a system of tracking and reporting environmental improvements
- Reduce the line organization's operational costs

The process used to perform a typical PPOA is outlined in Figure 1.

This PPOA was conducted for the SNL/CA Recycling Program between May 2006 and March 2007, to evaluate the current recycling program for potential opportunities to improve the effectiveness and efficiency of the program. In its Environmental Management System (EMS), SNL/CA set an objective to minimize the quantity of waste sent to the landfill, by a combination of reduced consumption and increasing reuse and recycling. A follow-on action was to investigate the feasibility of a centrally located solid waste sorting and collection facility, hereinafter called a recycling center.

The investigation and feasibility analysis covers all aspects of the recycling operation and has been guided by consideration of the following four options:

1. Continue the present recycling process and operations, with minor modifications and refinements.
2. Implement specific high priority improvements to the existing recycling process and operations.
3. Implement a basic recycling center to consolidate and improve existing recycling operations.
4. Implement a recycling center with associated equipment to attract best-value material recycling vendors and optimize potential revenue for all high impact recyclable waste streams.

Furthermore, the goals for the PPOA, stated early on and confirmed as the investigation progressed, are in the following priority:

1. Improve efficiency of recycling operations
2. Reduce maintenance costs associated with waste handling and recycling
3. Possibly increase revenues from recycling
4. Increase the number of waste/recycling streams managed
5. Operate more independently of LLNL. Alternatively, improve the collaboration with LLNL to the benefit of both entities.

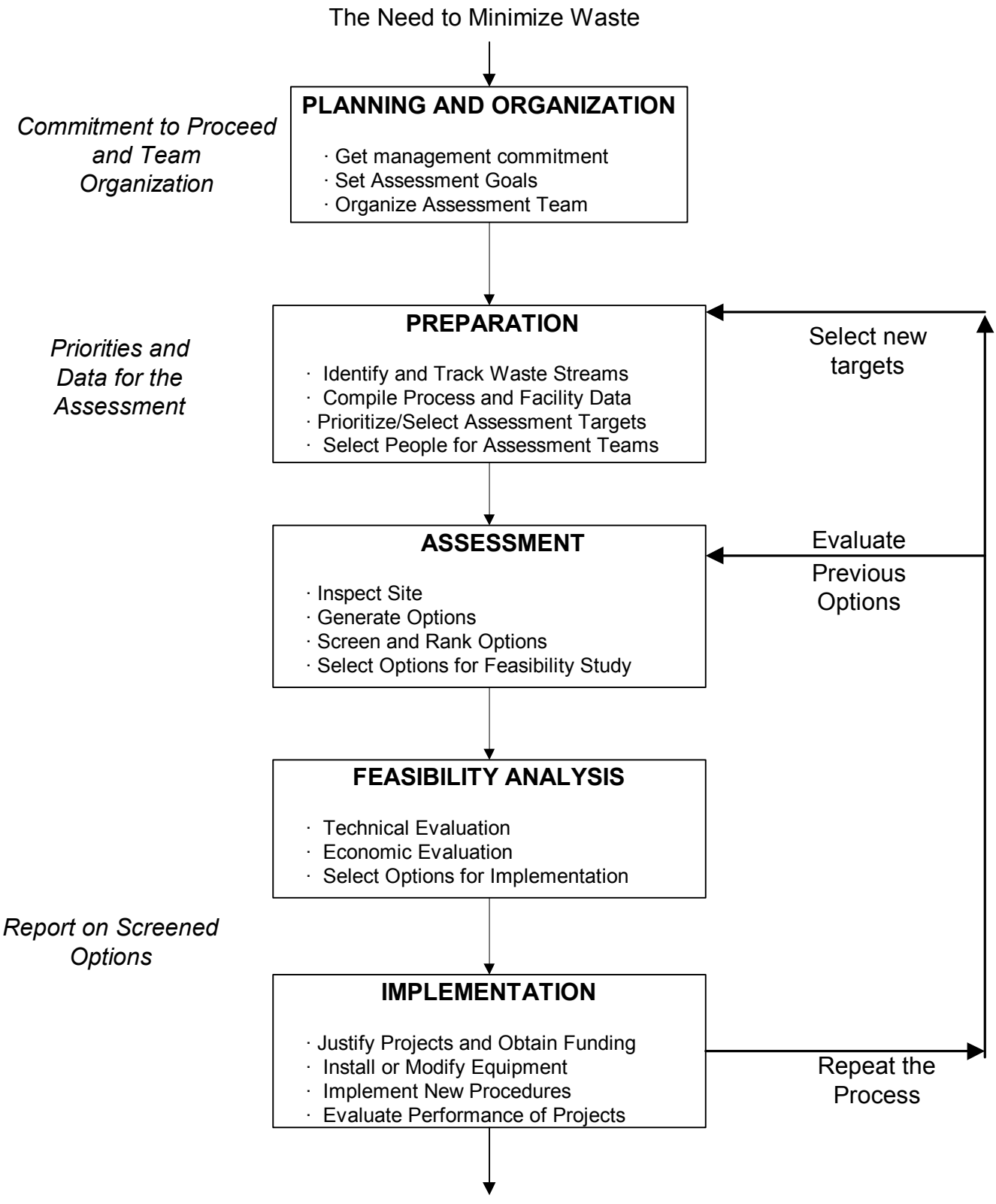


Figure 1. Pollution Prevention Opportunity Assessment Process

Efficiency of recycling operations can be defined either as "Lowering associated costs for the same recycling levels/quantities", or "Increasing revenues for the same recycling levels/quantities". Further, efficiency can be evaluated by metrics such as "how many times handled" and "how many containers/bins needed". These metrics can be evaluated before and after implementation, as one means to validate reduction of associated maintenance costs.

During the initial site visit by SNL/NM personnel and interviews with the SNL/CA maintenance personnel, the question was asked, "why do we want to be in this business?" The following discussion points address why SNL/CA would benefit from improving the efficiency of the site recycling operations, with an optimal end result including an on-site recycling center:

- First, SNL/CA is already "in the business" and now effectively recycles 21 waste streams, including cardboard, paper, wood, green waste, scrap metal, empty beverage and other containers, computer monitors and other electronic waste, and many others. However, the costs of the operation are high, spread among different departments and not well documented.

- Consolidating recycling activities onsite can decrease overall operating costs associated with the recycling program, by optimizing on-site collection, obtaining revenue for recyclable materials that currently is not realized, as well as reducing costs associated with contracted recycling and waste management services.

- SNL/CA dispositions several different materials through LLNL, such as scrap metal, monitors and other electronic waste, and office furniture. There is an agreement captured in writing, although not officially signed, and the transfer of materials is discussed in subsequent sections of this report. A copy of the unsigned MOU is included in Appendix A. Optimization of recycling activities can either position Sandia to operate independently of LLNL, or serve to improve the collaboration with LLNL for the benefit of both entities.

- By improving the efficiency of the current recycling operation, SNL/CA will be able to adapt or respond to changes associated with outside entities supporting Maintenance engineering, as well as to changes in regulations that affect waste operations in general or affect specific materials.

- Consolidation of recycling activities should better enable the FY07 target of increased quantities of materials recycled, in support of DOE Order 450.1 (change 2) recycling goals.

This report contains a summary of the information collected and analyses performed with recommended options for implementation. The SNL/NM Pollution Prevention (P2) staff (Organization 10331) worked with the SNL/CA P2 Staff (Organization 8516) to arrive at these options.

SNL/NM P2 can assist with implementation as much as necessary through technical and administrative input and can assist with seeking options for funding if necessary.

2. Recycling Program Overview

SNL/CA site consists of over 900,000 GSF in about 70 buildings on 413 acres. The fiscal year budget is more than $210 million.

The SNL/CA recycling operations are led by three P2 staff: the P2 Program leader, the P2 Project leader, and the P2 laborer, and supported by staff in the Maintenance Engineering Department. The Recycling Program annual costs are estimated to be $100,000.

In FY05, the site generated approximately 611 metric tons (mt) of routine solid waste, of which 165 mt (27%) was landfilled, and the remaining 446 mt were recycled, either directly or indirectly (via LLNL). In FY06, the site generated approximately 514 mt of routine solid waste, of which 160 mt was landfilled, and the remaining 354 mt were recycled. The routine recycling rate in FY06 was 69% and 73% in FY05. Revenues from recycling are limited and are not currently earmarked for improvements to the recycling program.

There are mixed paper recycling totes in each building and various recycling receptacles located in high traffic areas external to buildings. Containers designated for receiving cardboard are staged at approximately 20 locations. Areas of the Lab, such as the Reapplication/reclamation Area 17 and the fenced area adjacent to the Fire yard (south/southeast of building 968), are dedicated to the receipt of surplus or recyclable items and for staging scrap metal before it is transferred to LLNL. Further description of the waste/recycling streams and infrastructure can be found in Section 4.

Currently, and in place for a number of years, SNL/CA and LLNL have a cost-neutral working agreement to transfer scrap metal, electronic equipment waste and scrap furniture from SNL/CA to LLNL. The agreement is captured in writing, although not officially signed, and the transfer of materials is discussed in subsequent sections of this report. A copy of the unsigned MOU is included in Appendix A.

The current recycling program involves a number of different recycling vendors, in addition to the working relationship with LLNL. There are also separate agreements (contracts) with the same vendor for different services.

As indicated previously, the primary motivation for this PPOA is to examine the feasibility of establishing a recycle center, to improve the recycling infrastructure and improve recycling program efficiency. Four locations were identified as potential sites; the locations are shown on Figure 2 on the next page and the comparison is made in the next section.

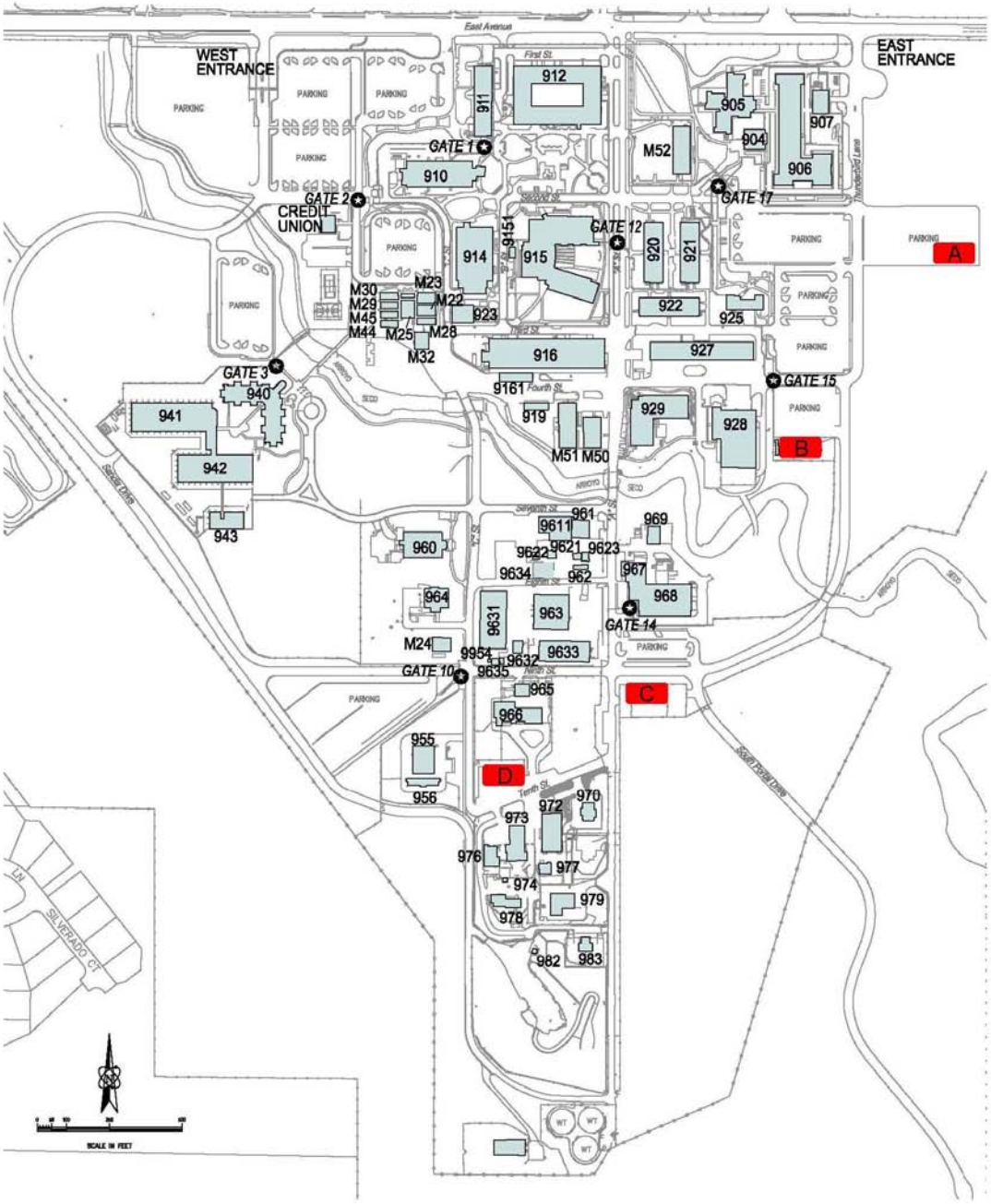


Figure 2. Recycling Center – Site Options

3. Assessment Methodology

With Management commitment in place, the process to perform a PPOA starts with data collection and preliminary assessment of the data. The SNL/CA P2 project leader provided the FY05 waste/recycle streams data, which was reviewed prior to the site visit on May 24 & 25, 2006 (see Appendix B). The top five recycle streams were immediately evident, and three of the top five align with the top three at the SNL/NM site: scrap metal, cardboard and mixed paper.

The presentation provided for the kick-off meeting on May 24 discussed the purpose and process of a PPOA and named the goals for this particular PPOA. In addition, since the CA Environmental Management Department has toured and recognized the utility of the SNL/NM C&D recycling center, the presentation also provided an overview of the NM recycling center.

Interviews on May 24 & 25 were guided by general questions on what worked well and didn't work well in their jobs with regard to efficient recycling operations, and what ideas they had to improve the recycling program. Staff members from the Maintenance Engineering and Project Engineering Departments were the prime interviewees. Notes of the actual interviews can be referenced in Appendix C.

In the course of follow-up interviews and working the action items list, a couple of opportunities were explored right away. The waste contracts were in the process of being renewed in June and we asked if the providers could be queried on what recycling services they provided, e.g., cardboard, wood. The thought was that perhaps there were "standard offer" recycling capabilities that could actually be revenue-generating, such that they could offset the cost of the annual waste management contract. The response from the waste management service providers, via the contract SDR, is that they did not have any recycling revenue offers.

As indicated previously, the primary goal of this PPOA is to improve the efficiency of the current recycling operation. The evaluation focused on determining the high priority recycle streams, i.e., the highest potential for having an impact in either reduced costs, higher recycling percentage, or deriving or increasing revenues. Also deemed necessary was to try to document the procedures and costs of the recycling operations, not only for contracts in place with service providers, but also for the associated operations in the Maintenance department.

The spreadsheet compilation of the 21 waste/recycle streams was sorted to yield the "heavy hitters". The top six waste streams by annual weight are all recycled and they comprise over 90% of the *recycled* quantities. These are scrap metal, green waste, mixed paper, wood, cardboard and electronic waste. See Figure 3.

The PPOA team next ranked these and several other recyclables according to the goals. The results of this ranking confirmed where to spend the most effort in seeking efficiency improvements; results can be found in Appendix D.

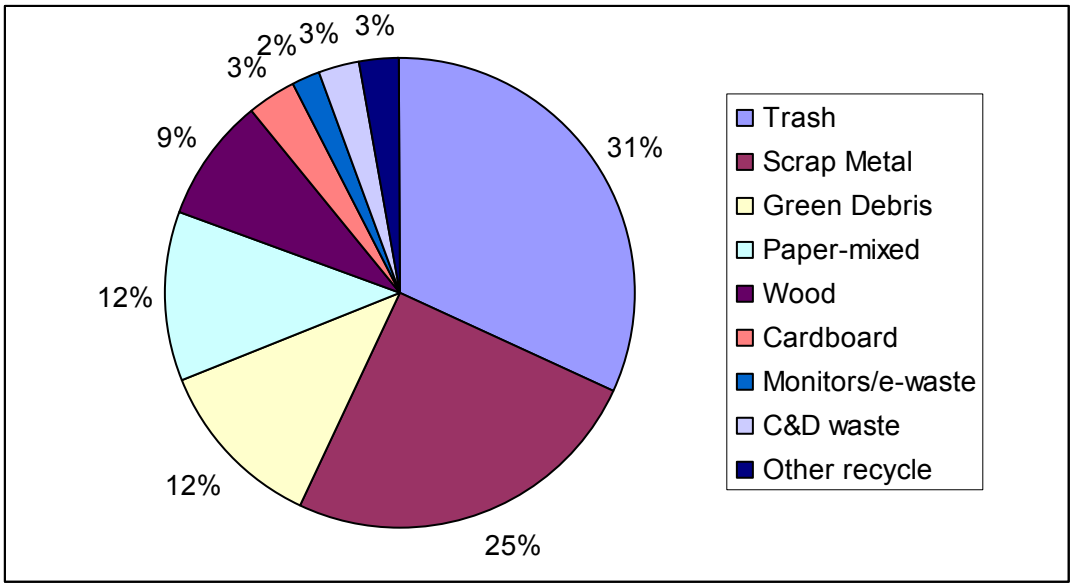


Figure 3. Breakdown of Trash and Major Recyclables

Another essential, initial step was to develop the list of potential sites and the associated pros and cons of each site. At minimum, the issues addressed were:

- Adequacy of site size
- Adequacy of access for trucks
- Availability of electricity
- Noise and/or dust issues
- Fenced or not
- Paved or not

Four potential sites were identified and evaluated. Two sites met most of the criteria and were kept for further consideration. Site B, near Post 15 and east of Building 928, is the preferred location, for multiple reasons, including: available size, proximity to Reclamation, availability of electricity, and closest to Post 15, the exit point for construction contractor traffic. Site options evaluation results are attached in Appendix E.

A presentation was made to the IDT on Thursday, 6/29/06 to announce the PPOA was underway and its scope. No exceptions or concerns were expressed. A quasi white paper was prepared prior to the IDT presentation by the SNL/NM P2 staff to address the question, "Why do we want to be in this business?" in case this question came up for discussion.

Progress meetings were held on a weekly basis to report on action items, and get clarification and feedback, and follow-up phone calls were made to expand on and/or get clarification from the site visit interviews. A presentation was made to SNL/CA on the draft final report on Sept. 27, 2006. Feedback and final clarification were sought to finish the report and its recommendations.

4. Waste and Recycling Streams

Presently, there are 21 different waste streams recycled at SNL/CA. These waste streams vary from small quantities of specific items/materials (such as oil filters and aluminum cans) to large quantities of general materials (such as scrap metal and cardboard). This PPOA focuses on those recycle streams that constitute the largest quantities generated as well as the largest potential for benefit to operations. Figure 4 illustrates the recycling trend for specific recycle streams. Based on the quantities of recyclable materials generated annually, the following recyclable waste streams are described in this Section:

- Cardboard
- Scrap Metal
- Green Debris
- Wood
- Monitors & Other Electronic Equipment
- Furniture

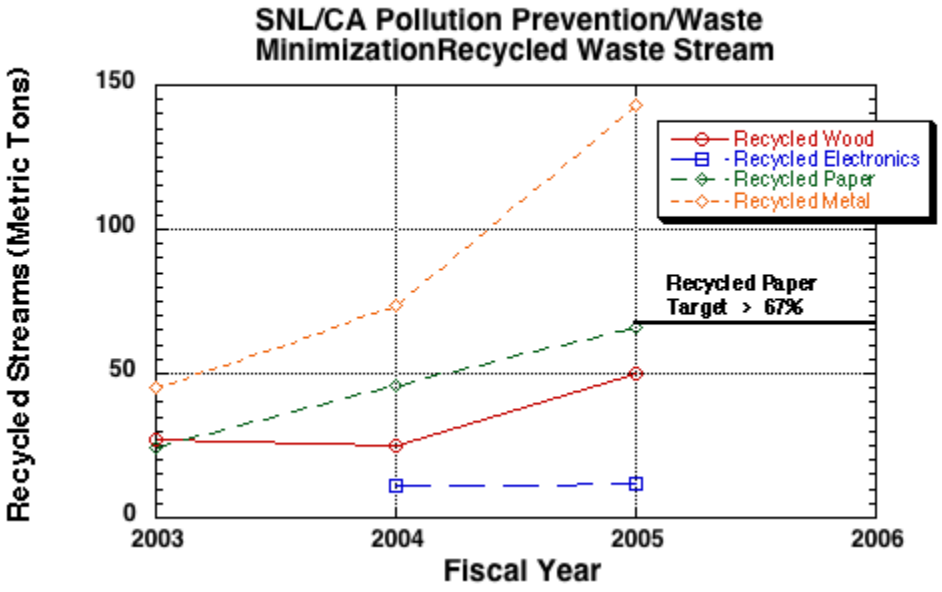


Figure 4. Recycling Trend

Office paper is a significant recycle stream, but is not addressed in this PPOA. A new contract for shredding and recycling office paper was established in late FY06 that reduced vendor service costs from $64K/year to approximately $8K/year. As a result, no changes to the office paper recycling program are considered. In addition, concrete and asphalt are also not discussed since generation of this material is infrequent and the quantities recycled in FY05 and FY06 indicate a significant difference in pickup requirements.

Other waste streams currently being recycled in small quantities or not yet included in the recycling program may also be applicable to the opportunities identified in this PPOA. These streams could include certain construction & demolition (C&D) materials, plastics, aluminum cans, glass, Styrofoam, etc.

The format below describes the generation, recycling process and estimated associated costs of each major recyclable waste stream, with Table 1 providing a summary. Labors costs were estimated based on discussions with site personnel to determine typical weekly labors hours associated with each recycle stream. A standard labor rate was assumed for site personnel involved in recycling program support.

4.1 Cardboard

Generation. SNL/CA recycled approximately 18 mt (19.5 tons) of cardboard in FY05 and approximately 20 mt (22 tons) of cardboard in FY06. Cardboard is generated by nearly all buildings' operations in the course of conducting day-to-day activities. Cardboard is separated from other waste material and deposited into designated collection containers. During the interviews, staff responsible for general trash collection and recycling pickup at the site noted that cardboard is also frequently placed within the general trash. Estimates are that about 20% of the cardboard waste generated is placed in trash dumpsters.

Current Recycle Process. Cardboard is collected at a number of locations throughout the site. A total of twenty 3-yard, wheeled front load dumpsters are designated for cardboard collection. Each individual at the site is responsible for breaking down their cardboard box, however, this rarely happens. The janitors remove all boxes and place them next to the cardboard container located external to the building. The P2 laborer breaks down the boxes and places them into the cardboard container. Approximately once a month, the containers are relocated to a central location east of Thunderbird Lane for collection by Waste Management, Inc. (WM). Once emptied, the containers are returned to their original locations around the site.

The P2 laborer moves the containers within the site using a forklift equipped with a scale. During the monthly container consolidation process, the quantity of cardboard collected for recycle is reported and the information maintained by the P2 program.

Waste Management, Inc. (WM) provides cardboard collection and transportation services at the site. The twenty 3-yard dumpsters are provided by WM. Using a front loader-type refuse collection truck, WM picks up the cardboard monthly and delivers it to the S. Front St. transfer station, and from there it is then transported to the Davis Street Recycling Center in San Leandro for recycling.

Table 1
Recycling Program Labor and Contract Costs

Material	FY05/FY06 Quantities (mt)	Annual SNL Labor, $ (50 wks/yr, unless noted)		Transportation Provider	Transport/ Disposal or Recycle Cost Basis$	Annual Trans/Disp Cost $	Estimated Annual Costs
Office Trash	181.88 (FY05) 159.99 (FY06)	$12,600	12 hrs/wk $21/hr	SNL	$33/ton (Rep. Service LF tip fee)	$4,943.66 (Rep. Service LF tip fee)	$17,293.66
Other Trash – Chairs, C&D Waste, etc	(incl. w/ above)	Unknown due to many users!		WM	$553.6/40-yd RO (WM delivery, pick-up, tip fee)	$9,964.80 (18 Bins/yr)	$9,964.80
Scrap Metal	142.95 (FY05) 136.90 (FY06)	$26,250	25 hrs/wk $21/hr	LLNL	$0	$0	$26,250.00
Landscape Debris - Grass - Tree/Shrub Trimming	68.23 (FY05) 80.02 (FY06)	$11,340	30 wks 18 hrs/wk $21/hr	WM	$150/30-yd RO (WM delivery, pick-up, tip fee)	$3,000 (20 bins/yr)	$3,000
Office Paper*	66.19 (FY05) 63.53 (FY06)	$3,528	3.36 hrs/wk $21/hr	Shred-IT	$8,000/yr	$0	$17,528
Wood/Pallets	49.83 (FY05) 20.23 (FY06)	$15,750	15 hrs/wk $21/hr	WM	$150/30-yd RO (WM delivery, pick-up, tip fee)	$1,800 (12 bins/yr)	$17,550
Cardboard	17.71 (FY05) 19;.91 (FY06)	$2,625	2.5 hrs/wk $21/hr	WM	$0	$0	$2,625
Concrete/Asphalt	15.39 (FY05) 1499.0 (FY06)	Unknown due to many users!		WM	$116/6-yd RO (WM delivery, pick-up, tip fee)	$2790.45 (15 bins/yr)	$2790.45
Computer Equipment	12.23 (FY05) 14.60 (FY06)	2 hrs/month $21/hr	$504	SNL to LLNL	$0	$0	$6,048
Furniture	20.3 (FY05) 20.3 (FY06)	2 hrs/month $21/hr	$504	SNL to LLNL	$0	$0	$6,048
Plastic, Glass, Aluminum Beverage Containers	Initiated late FY05 1.32 (FY06)	$1,575	1.5 hrs/wk $21/hr	NICA (or SNL)	Undetermined ($0.69/lb revenue)	Undetermined ($0.69/lb revenue)	Undetermined
Total Annual Costs (including trash disposal), $							$109,098
Total Annual Recycling Costs (excluding trash disposal), $							$81,839

NOTES:
*Renegotiated recently, down from $64K/yr
(1) Transportation provided by SNL/CA or LLNL are assumed $0
(2) Containers owned by SNL/CA or LLNL are assumed $0

Current Costs. No revenue is realized for the recycled cardboard and WM cardboard recycling services are provided at no cost. As a result, the costs associated with cardboard recycling are based solely on the labor requirements involved with the weekly container consolidation process.

- Weekly consolidation and relocation of twenty containers, (2.5) P2 Staff hours/wk, or $2,625/yr.
- WM collection container, pickup, and transportation fee, $0

4.2 Scrap Metal

Generation. SNL/CA recycled approximately 143 mt (157.3 tons) of scrap metal in FY05 and approximately 137 mt (150.9 tons) of scrap metal in FY06. Scrap metal is generated from a number of locations and activities at the site. Designated containers are used to collect and accumulate scrap metal for recycling. During the site visit for this PPOA, it was noted that no attempt is made to segregate different metal types. Scrap metal is generated primarily through Maintenance Operations, the Welding Shop, the Machine Shop, as well as through property reapplication.

Current Recycle Process. Small 2.5-yard tilt-hoppers are deployed for collection of scrap metal at specific locations around the site. Figure 5 shows a typical scrap metal collection hopper. Once full, the small hoppers are taken to the Reclamation Yard where the contents are rad-surveyed and screened for contamination and potentially sensitive information or materials. Once the scrap metal is cleared for recycling, it is placed into a single, LLNL-provided 40-yard roll-off container also located at the Reclamation Yard. Approximately 60 small hoppers owned by SNL/CA are used in the scrap metal recycling operations. There can be as many as 20 small hoppers filled with scrap metal awaiting clearance at the Reclamation Yard, while another 10 hoppers may be empty and waiting for deployment. Other hoppers are distributed at the site for use by scrap metal generators, such as the Maintenance Compound and the Test Assembly Group (TAG).

Scrap metal is commingled in the 40-yard roll-off container. Once the container is full, LLNL is contacted by the Property Management representative to arrange the removal of the full container and the drop off of an empty container. LLNL obtains a weight for the scrap metal and provides that information to the P2 program.

Current Costs. No revenue is realized for the scrap metal recycled and LLNL provides the roll-off container and pickup services at no cost. As a result, the costs associated with scrap metal recycling are based solely on the labor requirements involved with screening and managing the scrap metal hoppers used to collect metal at the Maintenance Compound, TAG area, and the Facilities Equipment Yard.

- Management of scrap metal collection hoppers and screening activities, (25) Staff hours/wk, or $26,250/yr.
- LLNL-provided container and transportation fee, $0

Figure 5. Typical Scrap Metal Bin Contents

4.3 Landscape Debris

Generation. Approximately 68 mt (75 tons) of green debris was recycled in FY05 and approximately 80 mt (88.2 tons) of green debris was recycled in FY06 , primarily from landscape and site maintenance activities. This material includes grass clippings, tree/shrub trimmings, tree cutting, and other miscellaneous materials such as street sweepings. A dedicated 30-yard roll-off container (owned by WM) located at Area 8 is used for accumulation of green debris. The roll-off container is filled one to three times per month depending on the season and landscape maintenance schedules.

Discussions with Landscape Maintenance personnel indicate that approximately 50 yards of grass clippings per month are generated during the growing season, while the tree trimming program generates approximately 50 yards per month. Tree removal generates another 90 yards per month, but only during winter months when nesting birds are not present at the site.

Current Recycle Process. Green debris is hauled by WM to the Altamont Landfill for recycling. Green debris sent to the Landfill is eventually transferred to another location for composting and resale to the public.

Current Costs. No revenue is realized for green debris recycled through the Altamont Landfill, and SNL/CA is charged a fee for accepting the material. However, a reduced fee is charged for accepting green debris relative to the cost of land-filled waste. SNL/CA is also charged a fee by WM for the roll-off container as well as a hauling fee. The labor costs are assumed to be the

same for the collection and placement into the roll-off container, regardless of whether the material would be disposed or recycled.

- Labor for managing green debris, (18) P2 Staff hours/wk, 30 wks/yr, or $11,340/yr (grass cuttings)
- WM container delivery, pickup, and tip fee at the Landfill, $150/30-yd Roll-Off (20 bins/year) = $3000/year

4.4 Wood

Generation. Approximately 50 mt (55 tons) of wood waste was generated in FY05, and approximately 20 mt (22 tons) of wood waste was generated in FY06, primarily pallets and shipping crates. Although there are attempts to reuse good condition pallets, the majority become wood waste. Construction and renovation projects also generate wood waste. A hopper outside Bldg 963 is dedicated for collection of dimensional lumber. A dedicated 30-yard roll-off container (owned by WM) located at Area 8 is used to collect wood waste, and is typically filled once per month to a maximum three times per month, on a year-round basis.

Current Recycle Process. Wood waste is hauled by WM to the Altamont Landfill for recycling, when notified by Maintenance Engineering. The Landfill processes wood waste through a chipper/shredder similar to the processing of landscape debris.

Current Costs. No revenue is realized for wood waste recycled via the Landfill, and a fee is charged. However, the fee is reduced relative to the cost for landfilled waste. SNL/CA is also charged a fee by WM for the 30-yard roll-off container, as well as a hauling fee. Sandia labor costs are assumed to be the same, whether the material would be disposed or recycled.

- Weekly wood/pallet collection, (15) P2 Staff hours/wk, or $15,750/yr.
- WM container delivery, pickup, and tip fee at the Altamont Landfill, $150/30-yd Roll-Off (12 bins/year) = $1800/year

4.5 Surplus Furniture/Chairs

Generation. SNL/CA has recent begun to quantify the amount of surplus furniture generated at the site. It is estimated that approximately 20 mt (22 tons) of excess furniture is generated annually. Surplus furnishings result from replacing existing furnishings that no longer serve the users needs, becoming outdated, not being ergonomic, or otherwise not being useable due to wear or damage. Once considered to be surplus, the furniture is sent to Reapplication for disposition. Figure 6 below illustrates typical surplus office furniture.

Furniture considered to be reusable is maintained as surplus inventory for potential reapplication onsite. However, there is a limit to the inventory of surplus furniture that can be maintained. Surplus furniture that exceeds the storage capacity of Bldg 927 is then sent to LLNL for disposition. Discussions with Office Furniture personnel indicate that approximately one shipment per month is sent to LLNL. The shipment typically comprises a 25-foot stack-bed truck that is double or triple stacked with surplus furniture.

Figure 6. Typical Surplus Furniture

Other surplus furniture that is damaged or has become a safety hazard is managed onsite as either scrap metal or solid waste. Four-wheeled chairs, for example, are considered a safety hazard and simply disposed as solid waste. Since the components of a chair typically include metal, wood, plastic, fabric, and a foam cushion, recycling of chairs has not been pursued.

Current Recycle Process. Surplus furnishings are either recycled or reused through LLNL-established methods. LLNL utilizes a number of pathways to disposition surplus furniture, including bulk sale auctions and/or donation utilization sales. As indicated above, surplus furniture not sent to LLNL that is damaged or otherwise not reusable (excluding chairs) is simply managed as scrap metal.

Current Costs. No revenue is realized for surplus furniture sent to LLNL for disposition. In fact, it is likely that a cost savings is realized by utilizing LLNL resources to disposition surplus furniture. The market value for surplus furniture would not likely cover the internal costs for SNL/CA to manage and oversee auction and/or donation programs. As a result, labor costs are assumed to be the same, since the activities conducted by Property Reclamation would occur regardless of whether the furniture was disposed or recycled.

4.6 Computer/Electronic Equipment

Generation. Approximately 12 mt (13.5 tons) of surplus computer/electronic equipment ("e-waste") was generated in FY05, and approximately 14.6 mt (16.1 tons) of was generated in FY06. Similar to furniture, e-waste results from replacing equipment that no longer serve the users needs, has become outdated, or otherwise not useable due to malfunction or operational failure. Once computer/electronic equipment are deemed non-useable, they are sent to Reapplication for disposition. Figure 7 illustrates typical surplus electronic equipment.

Figure 7. Typical Surplus Electronic Equipment

For the purposes of this PPOA, e-waste is defined as electronic equipment remaining in inventory after going through all attempts at reapplication/re-use on-site, donation to authorized K-12 computer equipment or auction via a Property Management approved reseller. Maintaining extra inventory of computer/electronic equipment is limited. E-waste is currently sent to LLNL for final disposition. Prior to the transfer, a high risk property review is conducted and an extensive process is used to sanitize such equipment, such as removal of batteries, recordable media, etc. Components such as hard drives, recordable media, etc. are removed and destroyed (observed and filmed) to ensure security protocols are satisfied.

Current Recycle Process. Sanitized computer/electronic equipment sent to LLNL are recycled, via contracts LLNL maintains with local vendors to take sanitized equipment for reuse, or for destruction and metal recovery.

Current Costs. No revenue is realized for surplus computer/electronic equipment sent to LLNL for recycling or destruction. In fact, it is possible that cost savings are realized by avoiding hazardous waste fees, instead utilizing LLNL means to disposition surplus computer/electronic equipment. As a result, the costs are assumed to be the same, whether the final disposition of e-waste was via LLNL or recycled via another means.

5. Description and Analysis of Pollution Prevention Opportunities

This section describes the options identified in the Introduction (Section 1) and is based on the priority waste/recycle streams described in the previous section. The options are described in sufficient detail to identify waste stream specific opportunities and enable a thorough analysis of the implementation potential, effectiveness in achieving P2 program goals, and cost impacts. As indicated in Section 1, the P2 Options to be evaluated are:

- Option 1 (Section 5.1): Continue the present recycling process and operations, with minor modifications and refinements.
- Option 2 (Section 5.2): Implement specific high priority improvements to the existing recycling process and operations.
- Option 3 (Section 5.3): Implement a basic recycling center to consolidate and improve recycling operations.
- Option 4 (Section 5.4): Implement a recycling center with associated equipment to attract best-value material recycling vendors and optimize potential revenue for all high impact recyclable waste streams.

Section 5.5 analyzes the Options and associated opportunities for feasibility of implementation and estimated costs to implement and operate.

5.1 Option 1: Minor Modifications to Existing Recycling Program

Minor modifications and refinements have been identified to improve the efficiency of collection and/or improvement to the recycling rates for currently recycled waste streams. These minor modifications are considered to be low cost opportunities ("best buys first") requiring primarily internal P2 support. The opportunities identified for Option 1 include:

Opportunity 1-a. Develop a Site Recycling Program operations procedure on recycling for the applicable Facilities Maintenance departments to improve collection, tracking and reporting. Define acceptable materials for recycling as well as cleanliness and what materials won't be recycled and therefore not deposited in the applicable recycling container. In particular, develop a procedure to track and record furniture quantities sent to LLNL and wood pallets stored onsite. Investigate the potential for tracking contractor-generated waste quantities removed from the site for construction and demolition (C&D) projects.

Opportunity 1-b. Develop robust signage on the roll-off containers in Area 8 to prevent contamination problems. The signage should clearly indicate acceptable and non-acceptable materials. Recycle containers recycling guidance developed at SNL/NM is offered that it may be modified for application to SNL/CA. Contamination of recycle streams, such as the roll-off containers in Area 8, invoke WM fees substantially higher than what is otherwise charged, which are absorbed by the Maintenance department budget. Samples of Recycling Guidance documents are attached in Appendix F.

Opportunity 1-c. Assess the need for citing additional scrap metal and wood collection bins. Although Reapplication may have a number of small tilt-hoppers available, additional containers may also be needed. Coordinating with Facilities activities (maintenance, renovations, D&D) would enable citing containers for project-specific use to expand collection of metal, wood, etc.

Opportunity 1-d. To reduce costs of wood recycling, periodically compact wood in the roll-off located in Area 8 with a backhoe to minimize void space caused by pallets.

Opportunity 1-e. As described in Section 4.1, the cardboard containers are staged throughout the site. However, according to the interviews, up to 20% of cardboard generated becomes misplaced in the solid waste stream. An awareness campaign directed toward the custodial staff as well as the general site population should strive to reduce the amount of cardboard currently being diverted from recycle containers. Such an awareness campaign could include special articles in the site newspaper, porcelain press, site-wide email alerts, and focused training conducted by P2 staff. Additionally, cardboard recycling posters could be created and distributed throughout the site. Additional labeling of solid waste containers could be created to indicate "NO CARDBOARD DISPOSAL" is allowed, as well as more visible, highlighted labels on containers dedicated for cardboard.

Opportunity 1-f. Additional awareness campaigns, similar to cardboard opportunity, to include other recycle streams such as metal and wood. These materials were noted as being commonly found in the solid waste stream.

Opportunity 1-g. Maintenance and Project engineering departments should work on a procedure to make certain excess Facilities material inventory (wallboard, ceiling tiles, paint, etc.) are first choice in remodel projects. Excess inventory represents additional costs to the warehouse. If not worthwhile to keep, it may be another opportunity to collaborate with LLNL before disposing. Excess soil has been deposited around the site that is problematic for ground maintenance. Investigate soil borrow practices at LLNL for potential partnering.

Table 2
Summary of Option 1 opportunities

Opportunity	Description	Cost
1-a	Develop Site Recycling Program operations procedure to improve collection, tracking and reporting	Low
1-b	Install signage on bins to clearly indicate acceptable and non-acceptable materials	Low
1-c	Stage additional scrap metal and wood bins	Low
1-d	Periodically compact wood pallets in roll-off	Low
1-e	Awareness campaign for cardboard to raise recycling level	Low
1-f	Additional awareness campaigns for wood & metal	Low
1-g	Develop procedure on excess material inventory to make it "first choice". If not, collaborate with LLNL or auction.	Low

Implementation of Option 1 opportunities, especially 1-a and 1-b, will result in more reliable recycling operations and the existence of documented procedures in this area could be accounted for in the overall framework of the site's EMS and ISO 14001 certification as a demonstration of improved environmental performance.

5.2 Option 2: Implement High Priority Improvements

Option 2 builds on the opportunities described for Option 1, by implementing a number of high priority improvements to the major recyclable streams. High priority is defined as those improvements which have the highest potential for increasing efficiency of recycling operations. The high priority improvements are focused on landscape debris, scrap metal and electronic waste.

Opportunity 2-a. A number of measures can be implemented to significantly reduce the green waste stream from requiring offsite transportation and disposition. The mowers currently in use collect grass clippings, which then get deposited in the "green waste" roll-off container located at Area 8. Attaching a micro-mulching deck to the mowers mulches the grass cuttings and reapplies them to the turf surface. Therefore, micro-mulching eliminates the need to manage grass clippings, in addition to the following other benefits:

1. reduces the amount of fertilizer and Round-Up (weed killer) applied to turf surfaces;
2. serves as a high nitrogen fertilizer, and;
3. reduces the water requirements of turf surfaces because it slows the evaporation of moisture in the soil.

Maintenance has a total of six mowers. One micro-mulching deck was ordered and has been put into service during the timeframe of this PPOA investigation. At a cost of approximately $400, equipping the remaining five mowers would cost an additional $2,000. Additional labor costs, maintenance and equipment storage requirements are expected to be minimal to implement this measure.

Opportunity 2-b. Landscape maintenance personnel also identified the potential to re-use tree/shrub trimmings, leaves, and storm drain waste. These materials could be processed by a chipper that can be reapplied as mulch in non-turf landscape areas at the site. The benefits of implementing this type of process are similar to the benefits of using grass-cuttings mulch. Costs would be reduced for purchase of bark material, WM container and transportation costs, as well as Altamont Landfill drop-off fees. Chipping would also save labor in packing, moving, and preparation work required to send tree waste to landfill.

The Maintenance department currently owns a chipper that is not-in-use. This chipper requires a mechanical power-take-off (PTO) energy source for operation, which is considered to be a safety risk. However, LLNL has a diesel-operated chipper that is no longer in service due to its replacement by a larger capacity wood-processing chipper. According to Maintenance personnel, the LLNL chipper is available at no cost other than the administrative procedures to transfer ownership of the equipment.

Tree removal operations are not included among the green debris opportunities. The current Tree Removal contract provides the necessary support to the grounds maintenance program. However, the tree removal is decided by Facilities and Maintenance organizations. The tree removal contractor should provide the quantities of green debris removed to the P2 program for tracking.

Opportunity 2-c. The largest potential revenue-generating recycle stream is scrap metal. Currently, LLNL accepts all scrap metal from SNL/CA and returns no revenue for the material. Property Management personnel indicate that this arrangement is in place primarily due to the inability to obtain recycling services for the quantities generated by companies with safe operating standards.

The approximate 143 mt and 137 mt of scrap metal generated in FY05 and FY06, respectively, indicates an average generation rate of 11.7 mt per month. The average weight of a 40-yard roll-off container of scrap metal is approximately 12,000 pounds, indicating that at least two shipments per month could be provided to a recycler. This quantity was found to be sufficient for obtaining the services of a scrap metal recycler.

A number of scrap metal recyclers exist in the Bay area that service the Livermore area. Custom Alloy Scrap Sales, Inc. (CASS), in Oakland, California, will provide a roll-off container for collection at no charge, separate metals collected by specific categories (such as heavy and light gauge ferrous metal, copper, aluminum, etc.) at their facility, and provide revenue based on the quantities of each specific category of metal. Potential scrap metal revenues range from approximately $40,000/year to $95,000/year (see Appendix G.).

The current process of collecting and screening scrap metal for potential security issues and radiation contamination would remain unchanged under this opportunity.

Opportunity 2-d. Surplus electronic equipment, such as computer monitors, is generated on an ongoing basis – a little over a ton per month. Although e-waste is currently transferred to LLNL per the MOU, a number of commercial e-waste recyclers exist within the Bay area that can provide recycling services at no cost (see Recycling Vendor information in Appendix H for Universal Waste Management Inc., in Oakland, California). California's Electronic Waste Recycling Act of 2003, SB20, became effective January 1, 2005, putting in place the structure for reduced costs of electronics recycling via State-approved e-waste recycling companies. This opportunity assumes the standard practice of high risk property review and equipment sanitization is conducted, as described in Section 4.6.

Depending on the quantities of precious metal-containing e-waste types generated (such as computer mother-boards), there is also the potential to obtain revenue for the recovery of residual value in e-waste by the recycling vendor (see Appendix H for ESC Refining in Santa Clara, California). These commercial recyclers not only guarantee 100% recycling or destruction (as necessary) of the e-waste picked up, but indicate they will also provide revenue for any resalable components. Utilization of such an e-waste recycling vendor would eliminate the costs and potential uncertainty associated with the periodic transport of e-waste to LLNL.

Opportunity 2-e. Besides office-generated e-waste, the Bay area e-waste recycler contacted also recycles other e-waste, such as laboratory test equipment, IC boards, etc. A simple audit/questionnaire could be performed to determine the potential generation of this category of e-waste. Then, a procedure could be developed for identification, collection, and palletizing such equipment for pick-up. Another option is to investigate collaboration with LLNL.

Table 3
Summary of Option 2 opportunities

Opportunity	Description	Cost
2-a	Micro-mulch grass clippings on turf for multiple benefits	$2000
2-b	Chip/shred tree trimmings on non-turf permeable surfaces. Obtain chipper from LLNL.	Low
2-c	Contract with scrap metal recyclers for monthly revenue	None
2-d	Contract with electronic waste recyclers for pickup of computer monitors & other office e-waste	None
2-e	Recycling other e-waste, e.g., lab test equipment	Low

5.3 Option 3: Basic Recycling Center

The site generates varying quantities of different recyclable waste streams. In general, recycling opportunities are always greater for large quantity waste streams, whereas recycling opportunities for small quantity waste streams tend to be restricted due to transportation costs and market value. Commingling small quantities of recyclable materials into a single large quantity improves the ability to obtain the services of recycling vendors as well as obtain revenue for the materials.

Option 3 is based on establishing a basic recycling center, with the focus being utilization of single source recycling services to the extent practical. The current recycling program involves a number of different collection areas, maintenance personnel, recycling vendors, haulers, and LLNL. Under this option, collection of recyclables would remain similar to the current process except that a centralized recycling center would be located to accumulate the materials until sufficient quantities have been generated for pick-up.

The basic recycling center is intended to consolidate the accumulation and management of recyclable materials to a single location, to the extent practical. Certain materials would continue to be managed as currently practiced, such as green (landscaping) debris, furniture, computer and electronic equipment, and scrap metal. The specific activities performed to accumulate and prepare these materials for recycling would not be easily relocated and therefore would remain as-is. However, recycling of cardboard, plastic, aluminum cans, glass, scrap wood and pallets, and concrete would be conducted at the recycling center.

Another aspect of Option 3 is the utilization of a single source recycling vendor to service the recycling center. The single source recycling vendor would provide all transportation and recycling services, and report recycled quantities and results to the P2 program. The major benefits of the single source recycling vendor are to simplify the contractual aspects of the recycling program, establish a single point of contact for recycling services, and provide opportunity to easily add new materials for recycling.

As a convenience to Facilities personnel and contractors, a C&D waste collection container would also be located at the recycle center. This one container, and potentially the concrete container, would continue to be serviced by Waste Management (as currently practiced). The primary reason to continue this limited service through Waste Management is minimize cost, as the single source recycler does not manage C&D waste intended for landfill disposal.

Utilization of the P2 labor and maintenance personnel assigned to serve or complement the recycling center would be optimized by a Site Recycling Program operations procedure. To the extent practical, recyclable materials would be categorized to enable recycling more materials with fewer containers. The intent is to reduce the number of specific containers required for collection around the site (as applicable) as well as reduce the number of accumulation containers (roll-off containers) required to enable transportation offsite. As appropriate, categories of recyclable materials would be commingled into single category streams to utilize the services of a single stream recycler, such as a vendor located in Oakland.

Recycling vendors generally relate cost/revenue to quantities of materials. That is, the larger the quantity they pickup the less cost is incurred and the more likely that revenue can be realized. Since the site generates relatively smaller quantities of materials (excluding perhaps scrap metal), commingling for the purpose of generated a larger quantity is desirable. To further improve the cost-effectiveness of recycling quantities, use of a compactor or baler may be advantageous. Single source recycling vendors have a variety of means to providing customers such equipment. There are rental, rent to own, buyback, and vendor-supported purchasing of such equipment. Based on the material types and quantities generated, a compactor is more practical than a baler. Balers are more expensive to operate and are not practical for commingled streams due to the difficulty of separation at the recycling vendor's facility. The compactor would be integrated with a roll-off container to ensure maximum material quantities for transportation.

Revenue would be obtained for various single (commingled) streams based on market value. However, utilizing a single source recycling company would likely result in some type of offset cost where certain materials incur cost to recycle while others generate revenue. Additional evaluation is required to determine actual costs or revenues from this type of arrangement. A general proposal from one identified Single Source Recycling vendor (California Waste Solutions) is included in the Recycling Vendor information provided in Appendix H.

Single stream recycling categories could include:

Category 1: Cardboard, Plastic (all grades), Glass (all types), Aluminum Cans, Paper (mixed)
Category 2: Electronics (CRTs, CPUs, copiers, fax machines, phones, power supplies, power strips, other components, etc.)
Category 3: Metals
Category 4: Furniture
Category 5: Concrete
Category 6: C&D Waste

The single source recycling vendor contacted in support of this PPOA (California Waste Solutions) indicated a high desire to do business with SNL/CA and a willingness to negotiate costs relative to the current costs being incurred for recycling services. The initial proposal provided (see Attachment H) indicates a $300 to $450 per haul for the various categories of recyclable materials. Although these costs could be negotiated down, there would likely be a cost increase for the single stream recycling service relative to the current overall recycling services costs.

Option 3 is best served by the implementation of the measures identified in Option 1 (improve awareness and develop procedures) and can include Option 2 (scrap metal recycling revenues, utilize landscape waste as a resource onsite, and recycle e–waste through State-approved recycling companies).

The preferred site for the Recycling Center is site B, south of Post 15. This area is 210 feet wide by 105 feet deep, with an additional piece (70'W x 40' deep) at the SE corner, for a total area of nearly 25,000 SF. The handling capabilities for the proposed recycling center are based on the known area requirements of the NM site C&D recycling center (see Appendix I), which is 300 feet deep by 175 feet long (52,500 SF), and has space for 5-7 roll-off bins and 7-10 hoppers (2.5- to 4-yd tilt hopper type), and room for staging bulk materials. For operations described in Option-3, site B is considered more than adequate. Figure 8 presents a conceptual layout of the recycling center located at the preferred site.

The cost to prepare site B to function as a basic recycling center is not provided in this PPOA. SNL/CA site engineering resources are better suited to estimate costs for site preparation requirements such as grading, storm water management, access points, signage, fencing, etc. The only equipment costs associated Option 3 is replacement of 20 cardboard collection containers currently owned by WM, Inc. (~ $14,000) The annual cost for services and operation of the recycling center is estimated to be approximately 10 man-hours per week of P2 labor staff, or $10,7500. The operating costs are assumed to be covered by the P2 project budget for the labor staff. Although potentially lower negotiated costs may be possible, revenues from recycled materials using a single stream recycling services are uncertain. As a result of the uncertainties associated single stream recycling service costs, Table 4 provides an upper limit estimate of the costs associated with Option 3.

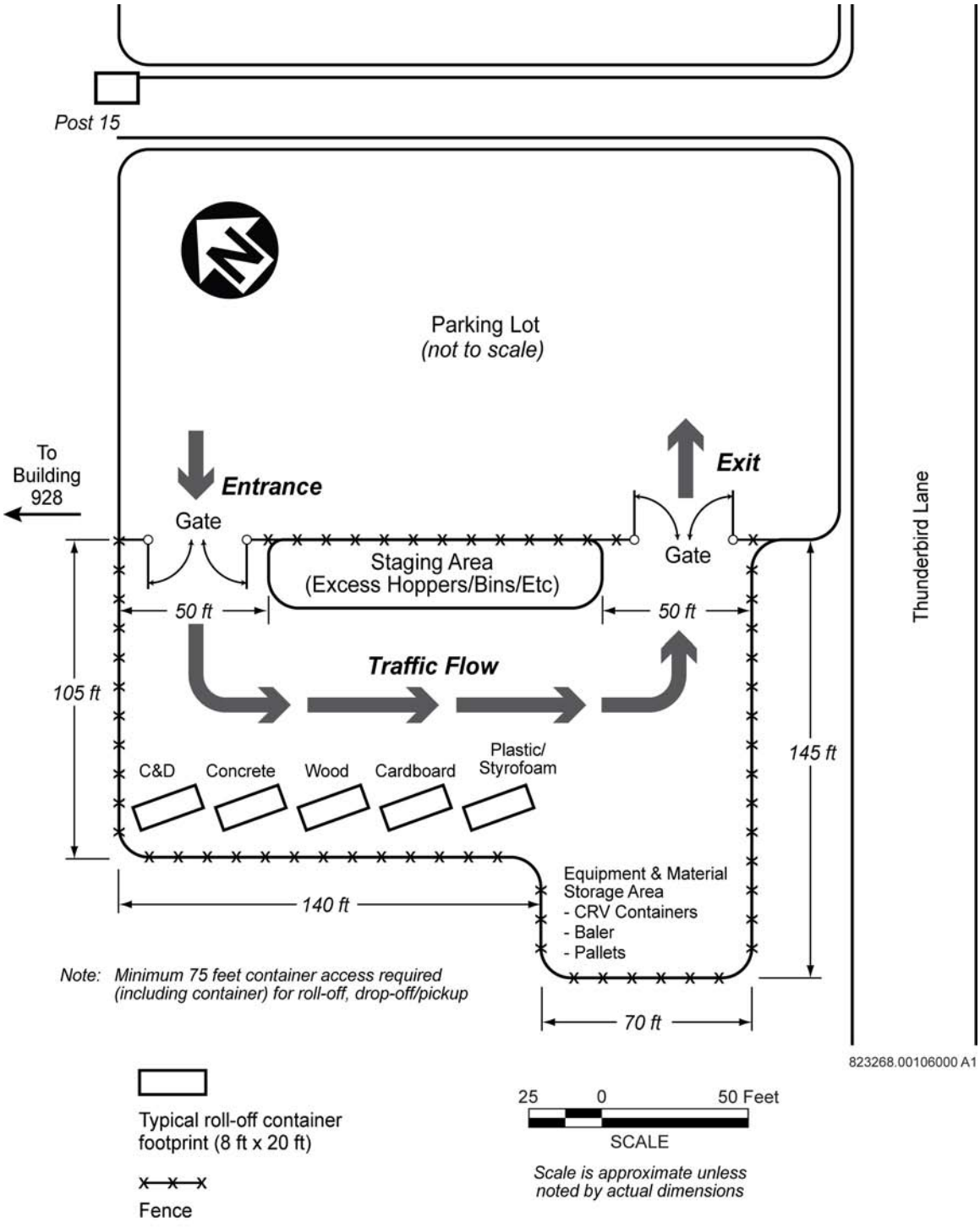


Figure 8. Potential Recycling Center Configuration for Site B

Table 4
Option 3 Cost Summary

Option Feature	Costs
General Site Preparation	TBD
Collection Containers (for cardboard)	$14,000
Total	$14,000+Site Prep
Operations	**Annual Costs**
Annual Operations	$10,750
WM Services (C&D waste)	~$5,000
Single Source Recycle Vendor	
• Cardboard	$3,600 (12 loads/yr)
• Metal	$9,600 (24 loads/yr)
• Wood	$4,800 (12 loads/yr)
• Electronics	$4,800 (12 loads/yr)
• Furniture	$4,800 (12 loads/yr)
• Plastic (#1-#5)	$900 (2 loads/yr)
• Mix (Other – Styrafoam, misc.)	$2,700 (6 loads/yr)
Total	$46,950
Material	**Potential Annual Revenue**
Revenues uncertain due to vendor non-committal	

5.4 Option 4: Recycling Center for Expanded Program

Option 4 expands the basic recycling center described in Option 3. Recycling services would be identified on a stream-by-stream basis to obtain the best value for each specific recycle stream. The option involves establishing accumulation containers for as many separate types as practical. Given the space constraints, the expanded recycling center could be a hybrid of Option 3, but still configured for additional roll-off containers as well as several other large, transportable hoppers for segregated higher value, small quantity materials.

Similar to Option 3, certain materials would continue to be managed as currently practiced, such as green (landscaping) debris, furniture, computer and electronic equipment, and scrap metal. The specific activities performed to accumulate and prepare these materials for recycling would not be easily relocated to the recycling center and therefore would remain as-is. However, the recycling center would contain spatial allowances for accumulation of materials that bring higher revenue value, including cardboard and reusable wood pallets. Option 4 seeks to maximize potential revenue value for recyclables as a means of paying for implementation costs as well as a funding source for future recycling activities and initiatives.

The Option 4 recycle stream categories could include:

Category 1: Cardboard (baled at the recycle center and stored for transport by recycling vendor to optimize revenue – see Appendix G).
Category 2: California CRV containers (plastic bottles, aluminum cans, and glass bottles stored separately in appropriate dumpsters or a compartmentalized roll-off)
Category 3: Metals (utilizing recycling vendor container located at Reclamation Yard)
Category 4: Wood Pallets (stacked for loading onto recycling vendor truck)
Category 5: Scrap Wood (collected in recycling vendor provided roll-off container)
Category 6: E-Waste (picked up at Reapplication by appropriate recycling vendor)
Category 7: Furniture (picked up at Reapplication by appropriate recycling vendor)
Category 8: Concrete (collected in recycling vendor, WM, provided roll-off container)
Category 9: C&D Waste (collected in WM provided roll-off container)

As indicated previously, scrap metal, electronics, and furniture would continue to be collected and staged as is currently practiced. However, a recycling vendor would be providing the roll-off container for metal (as opposed to LLNL) and transportation from the site. Similarly, electronics and furniture would be loaded onto a recycling vendor's truck for transport to the recycling facility (as opposed to loading onto a SNL/CA truck for transport to LLNL).

To ensure such a full-scale recycling center is utilized to the maximum extent possible, Option 1 measures should be fully implemented by this time. As a fully integrated waste recycling center, the facility could also be capable of accepting non-recyclable waste for disposal. In this manner, users of the facility could deposit recycle materials and waste, so as to save a trip to a garbage dumpster in a different location.

One such procedural document for defining waste management requirements for maintenance, construction, and D&D activities is Specification 01505, Construction Waste Management, which could require utilization of the recycling center. This process is similar to that being implemented at SNL/NM for C&D waste management. A truck scale would facilitate tracking and reporting of recyclable materials transported offsite, including those materials picked up as partial loads by vendors making collection routes. However, space and cost constraints may prohibit the truck scale.

This Option represents a completely integrated waste management facility, similar to a transfer station. Significant resources and funding would be required to plan, design, implement and operate such a facility. The preferred site for the recycling center is the same as described in Option 3, south of Post 15 and east of Bldg 928. Figure 8 presents a conceptual layout of the recycling center located at the preferred site.

The estimate to prepare the site to function as the recycling center is not provided in this PPOA. SNL/CA site engineering resources are better suited to estimate costs for site preparation requirements such as grading, storm water management, access points, signage, fencing, etc. Equipment costs could add an additional ~$25,000. The annual cost for services and operation of the recycling center is estimated to be approximately 20 man-hours per week of P2 labor staff, or $21,500. The operating costs are assumed to be covered by the P2 project budget for the labor

staff. Option 4 is estimated to generate approximately $43,000 to $99,000 in revenue on an annual basis (see Appendix G). Table 5 provides a summary of the estimated costs associated with Option 4.

Table 5
Option 4 Cost Summary

Option Feature	Costs
General Site Preparation	TBD
Collection Containers (for cardboard)	$14,000
Baler	$10,000
Total	$24,000+Site Prep
Operations	**Annual Costs**
Annual Operations	$21,500
Continued WM Services	$13,000
Total	$34,500
Material	**Potential Annual Revenue**
Metal	~ $40,000 to $95,000
Cardboard	~ $400 to $1,350
Wood Pallets	~ $525
E-Waste	~ $1,000
CRV Containers	~ $1,000
Total	~ $42,925 to $98,875

5.5 Options Analysis

The four options described above were analyzed for improving the effectiveness and efficiency of the SNL/CA recycling program. The analysis is qualitative and attempts to assess each Option against the goals established for this PPOA, also considering the feasibility of implementation, to guide the most practical and effective path forward. Table 6 presents the qualitative assessment of PPOA Options.

Table 6 indicates the options progressively build on meeting the PPOA goals until Option 4, which increase operational costs. However, it should be noted that recycling revenues could potentially cover any increased costs associated with the operation and maintenance of a recycling center. Conversely, the uncertainties associated with revenues from a single stream recycler (Option 3) could potential negate any reduction in operation and maintenance costs. As a result, the only option capable of meeting all the goals established for this PPOA is Option 4, Recycling Center for Expanded Program. This result indicates a benefit to implementing one or more elements from Options 1 through 4 in a phased approach to continually improve the effectiveness and efficiency of the SNL/CA recycling program. The primary element to Option 3 that can benefit SNL/CA is access to a broad range of material recycling capabilities through a single vendor.

Table 6
Recycling Options Analysis Summary

Evaluation Criteria	Recycling Improvement Options			
	Option-1	**Option-2**	**Option-3**	**Option-4**
Meeting PPOA Goals				
Improve Efficiency	Yes	Yes	Yes	Yes
Reduce Maintenance $	Yes	No	Yes	No
Generate Revenue $	No	Yes	Uncertain	Yes
Add Recycle Streams	No	No	Yes	Yes
Improve Collaboration w/ LLNL	No	Possibly	Yes	Yes
Implementation Potential				
Implementation Feasibility	High	High	Medium	Medium
Implementation Cost	Low	Low	High	High
Management Approval	High	High	Low	Low

The implementation potential for Options 1 and 2 appear straight-forward and are based primarily on administrative procedural changes to the existing recycling program. Option-3 and Option-4 will require appropriate planning and budgeting actions to implement. Revenue associated with implementation of Option 2-c (see Table 3) could provide, or significantly offset, the budget requirements associated with establishing and operating a recycling center.

6. Conclusion

A total of four options have been developed to improve the effectiveness and efficiency of the SNL/CA recycling operations, based on an assessment of the waste generation data, processes and procedures associated with the current recycling program as well as other solid waste streams. Each option was evaluated against the goals defined for this PPOA:

1. to improve efficiency of recycling operations,
2. reduce recycling program maintenance costs,
3. obtain revenue from recyclables,
4. increase the number of recycling streams, and
5. optimize collaboration with LLNL.

The current recycling/reuse relationship with LLNL is beneficial from the standpoint that no cost or liability is incurred for disposition of e-waste, furniture and scrap metal. However, scrap metal represents the largest potential recycling revenue source. Since e-waste can be recycled through commercial vendors at no cost other than transportation, and perhaps become cost-neutral and furniture could be recycled as described in Option 3, the highest recommendation of this PPOA is to pursue these avenues for the remainder of FY07 and set a timetable for their implementation through discussion with LLNL (Donation Utilization and Sales).

The crux of the matter for changing course from the current arrangement with LLNL seems to be the issue of e-waste recycling through commercial vendors. As stated previously, this step assumes the following still occurs, in hierarchical order: 1) re-application of re-usable electronic goods, or 2) high risk property review, and 3) appropriate sanitization and palletizing of e-waste . As one means to discuss and resolve this concern, P2 staff and Property management staff from both sites could meet according to a pre-determined agenda. Video-conferencing can be arranged to make the meeting more conducive to multiple schedules.

The options described herein should be implemented on a phased approach that focuses on streamlining operations to lower associated maintenance costs and maximizes revenue potential for existing recycle streams to support the overall program, and enables opportunities to increase the types and quantities of materials recycled. The following describes a potential timetable for implementation of Options 1 & 2, and elements of Option 3, setting the stage for implementation of Option 4:

FY07: Although mid-way through FY07, the items identified below represent primarily administrative activities and an emphasis on establishing recycling services for the revenue generating recycle streams.

Develop and implement the awareness program to maximize separation and collection of the current recycle streams that are commonly misplaced into the solid waste stream or contaminated with non-recyclables. This includes signage on the Area 8 roll-off containers that depicts acceptable and non-acceptable materials, as well as identification of resources for additional information. Implement additional training of custodial and site personnel on recyclable materials separation requirements and locations of recycle containers (Option 1, Section 5.1).

Establish contracts with scrap metal recycling vendors and electronics vendors to begin obtaining revenue as described under Option 2-c (Section 5.2). Institute cost code for accumulation of recycling revenues to reinvest in the recycling program and operations.

Institute a tracking program to quantify furniture transported to LLNL and pallets stored on-site for reuse (Option 1-a, Section 5.1).

Following the awareness program, pursue procurement of the resources necessary to reduce or eliminate off-site disposition of green waste generated by grass cutting and tree/shrub trimming (Option 2-a and 2-b, Section 5.2)

Confirm and negotiate if necessary for the location of the future recycling center at Site B (nearest Post 15). If resources available at year end, secure design assistance to design the layout of and utilities for the recycling center, and obtain cost estimate (Option 4, Section 5.4).

Secure FY08 funding for a recycling center to support implementation of elements from both Options 3 and 4, as appropriate. Develop plan that targets best value recycling vendors to provide containers, transportation and recycling services for the highest revenue potential recycle streams. Include a least one single source recycling vendor to provide container(s), transportation and recycling services for commingling of small quantity waste streams that are not already being recycled (new recycle streams). The plan should include integrating site recycling operations and the recycling center, such as delivery of recyclables to recycling center.

FY08: Continue and refine implementation of Options 1 and 2. Implement elements of Options 3 and 4, as appropriate, based on the Recycling Center Plan with an emphasis on increasing the number of recycle streams (though commingling) using a single source recycling vendor and P2 site support (Option 3 and 4, Section 5.3 and 5.4). Ensure the refinements and modifications made in Options 1 & 2 are meeting objectives and functioning as needed.

FY09: Continue and refine operations of a Recycle Center (Options 3 and 4, Section 5.3 and 5.4).

In addition to meeting the goals established for this PPOA, each of the four options developed will satisfy, to varying degrees, the EMS objectives to continually reduce the quantity of waste sent to the landfill, by a combination of reduced consumption and increasing reuse and recycling.

SNL/CA should pursue further collaboration with LLNL for other potentially recyclable materials that could benefit both sites. Excess materials stored to support Facilities operations, such as carpet, ceiling tiles, wallboard, etc., when deemed surplus could be provided to LLNL for supporting their operations or for streamlined disposition of larger quantities of those materials.

Once this PPOA and its recommendations have been discussed, evaluated and implemented, the Memorandum of Understanding between SNL/CA and LLNL should be revisited, and revised to

represent the agreed upon transfer of recyclable or reusable materials and accordingly signed by the appropriate levels of management.

Appendix A
Memorandum of Understanding with LLNL

MEMORANDUM OF UNDERSTANDING
BETWEEN
SANDIA NATIONAL LABORATORIES
AND
LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL)
FOR DISPOSITION OF EXCESS AND SURPLUS PERSONAL PROPERTY
AT
LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL)

Introduction

This Memorandum of Understanding (MOU) is entered into by and between Sandia and LLNL, and outlines the respective administrative and programmatic roles and responsibilities related to the disposition of excess and surplus personal property managed by Sandia National Laboratories. The intent of this MOU is to obtain LLNL support in disposing excess and surplus personal property physically located at Sandia.

Agreement

LLNL agrees to dispose, at no cost to Sandia National Laboratories, of excess and surplus personal property. It is understood Sandia National Laboratories shall receive no reimbursement from LLNL for this property. Property identified as excess to the needs of Sandia National Laboratories will be transferred to LLNL utilizing Sandia National Laboratories Policies and Procedures and in accordance to Federal and NNSA/DOE Property Management Regulations. Roles and responsibilities of this agreement are outlined below.

Sandia Property Administrator:

1. Prepare an itemized listing of excess and surplus items on a Transfer Order (SF122) form to include: nomenclature, property number or unique identifier, acquisition cost, acquisition date, and condition code. The SF122 will be forwarded to the LLNL Excess Manager for signature upon acceptance of the assets.

2. Remove all property identification tags such as property numbered tags, Property of Government or other identification tags, labels, stickers or placards, and replace with the line item number corresponding to the line item number reflected on the SF122.

3. Ensure all equipment has been evaluated and meets the established NNSA/DOE standards related to environmental safety and health, high risk, and/or computer security.

4. As appropriate, stage equipment based on “like” items, consolidate and tape together computer systems (CPU, monitor, keyboard, and mouse).

5. Coordinate and schedule delivery to LLNL. Mode of delivery will be at the discretion of Sandia National Laboratories.

6. Prepare property authorization to transfer all capital assets (items with an acquisition value of $25K or higher) to LLNL via a Transfer Voucher Form (CR325).

LLNL will:

1. At receipt, review itemized listing(s) to ensure accuracy, and sign and forward documentation back to a Sandia Property Administrator.

   Note: Signature represents transfer of accountability from Sandia to LLNL.

2. As applicable, complete the financial transfer of capital assets in accordance with established Federal and NNSA/DOE standards and regulations.

3. Screen and dispose excess and surplus materials and equipment in accordance with Federal and NNSA/DOE Property Management Regulations, and in accordance with other state and/or local requirements.

Clauses:

Funding. This MOU shall not be used to obligate or commit funds or as a basis for the transfer of funds.

Effective Date: This MOU shall become effective upon the date of signature of both parties and shall remain in effect until December 30, 2005.

Amendments. This MOU may be amended by written agreement between Sandia National Laboratories and LLNL.

Termination. This MOU can be terminated by LLNL or Sandia National Laboratories by submitting in writing, through the respective contract officer of either party, requesting a termination of the MOU.

MOU Approval Signatures

_____ _____

Lynn McClellan Date
Sandia National Laboratories

_____ _____

Al Olsen, Group Leader, Donation, Utilization, and Sales Date
Lawrence Livermore National Laboratory

_____ _____

Sal Ruiz, Division Leader, Property Management Division Date
Lawrence Livermore National Laboratory

Appendix B
FY05 and FY06 Waste/Recycle Stream Data

Waste Stream	Current disposal means	Preferred disposal Option	Unit	Unit (cost) or revenue	mT (FY05)	% of waste stream	(Cost) or Revenue	Destination
Trash	landfill	Solid waste	m-ton	($33)	181.88	31.9%	($6,002)	Republic Services-Vasco Road Landfill
Scrap Metal	LLNL	Recycle	m-ton	0.00	142.95	25.1%		LLNL
Green Debris	composted at landfill?	Mulched on site	30 yd bin	($150.00)	68.23	12.0%		Waste Management-Altamont Landfill
Green Debris/mixed	landfill		40 yd bin	$508.40 (Mixed/Trash)				Waste Management-Altamont Landfill
Paper-mixed	Recycle	Recycle		0.00	66.19	11.6%	($64,000)	Shred-IT
Wood	landfill	Chipped	30 yd bin	($150)	49.83	8.7%		Waste Management-Altamont Landfill
Cardboard	Recycle	Recycle	m-ton	0.00	17.71	3.1%	0	Waste Management-South Front Street-Livermore/Davis Street Recycling Center
Asphalt/Concrete	landfill	Recycle	ton	($33.00)	15.39	2.7%	($507.87)	Waste Management-Altamont Landfill
Monitors, other e-waste	LLNL	Recycle		0.00	12.23	2.1%		LLNL
Resin /Resin Bottles Anion Cation Carbon Copper Removal		Recharged Recharged Recharged Recycled		Paid by 8236-2 ($482.00/ea) ($246.00) ($384.00) ($00.00)	4.71	0.83%		U. S. Filter
Batteries- Mercury Alkaline		Recycle Recycle Recycle		($218/30-gal) ($0.28/lb) ($448/5-gal) XXX	3.22	0.56%		Teris, NA (Haz Waste Handling)

Waste Stream	Current disposal means	Preferred disposal Option	Unit	Unit (cost) or revenue	mT (FY05)	% of waste stream	(Cost) or Revenue	Destination
Fluorescent Tubes	Recycle	Recycle	Tube	4' $0.28, 8' $0.56, HID $1.25, U-tubes $0.50 Compact Tubes .50each Shipping Charge $85.00/load Fuel Surcharge $35.00/load	2.44	0.43%		AERC Recycling Solutions
Oil		Recycle	55 gal drum	(56.00)	2.25	0.39%		Teris, NA (Haz Waste handling)
Empty Containers		Recycle	Each	0.00	0.82	0.14%		Waste Management-South Front Street-Livermore/Davis Street Recycling Center
Toner Cartridges	Recharged			0.00	0.79	0.14%		Arista Business Imaging Solutions
Tires		Recycle			0.75	0.13%		California Waste Tire Management
Wallboard		Recycle		0.00	0.45	0.08%		Construction debris was taken offsite by our demolition contractor to local recyclers
Oil Filters		Recycle	55 gal drum	(95.00)	0.24	0.04%		Teris, NA (Haz Waste handling)
CFC's		Recover & Reclaim		($40/per unit)	0.14	0.02%		Freon Free at the Vasco Road Landfill for Recycling
Aluminum Cans	Recycle	Recycle	lb	1.25	0.09	0.02%	$252.00	Refund Recycling

Waste Stream	Current disposal means	Preferred disposal Option	Unit	Unit (cost) or revenue	mT (FY05)	% of waste stream	(Cost) or Revenue	Destination
Mercury-Elemental		Recycle		($224/5gal) ($8.00/lb)	0.01	0.00%		Teris, NA (Haz Waste handling)
Carpet Tiles		Recycle	8 pallets	($250.00)	0			Anderson Carpet & Linoleum Sales
Ceiling Tiles		Recycle	Roll-off	($300.00-Roll-off) & $50.00/ton	0			Waste Management-Altamont Landfill
Coolant		Recycle			0			Teris, NA (Haz Waste handling)
Empty 55-gal drums		Recycle	Each	(28.00)	0			Teris, NA (Haz Waste handling)
Fire Extinguishers		Recycle		0.00	0			Coast Fire
Gas Cylinders		Recycle			0			Teris, NA (Haz Waste handling)
Gas Cylinders-PIH		Recycle			0			SET Environmental
Glass Beverage		Recycle	Lb	(0.08)	0			Refund Recycling
Pipette Box		Recycle		0.00	0			Matrix Technologies Rainin
Plastic Beverage		Recycle	lb	0.69	0			Refund Recycling
Batteries-Nicad		Recycle	30 gal	($218.00)				Teris, NA (Haz Waste handling)
Batteries-Lead Acid		Recycle	lb	($0.28)				Teris, NA (Haz Waste handling)
Mercury-Inorganic compounds		Recycle		(8.00)				Teris, NA (Haz Waste handling)
Total Weight, mT					570.32			
Costs do not include labor or shipping charges								

Fiscal Year 2006 Data
(Quantities in Metric tons)

	Q1	Q2	Q3	Q4	FY06 Total
Aluminum Cans	0.26	0.08	0.15	0.13	0.62
Batteries	1.46	0.83	0.70	0.39	3.38
Cardboard	8.76	4.05	1.62	5.48	19.91
Carpet tiles	0.00	0.00	0.00	0.00	0.00
Ceiling tiles	0.00	0.00	0.00	2.06	2.06
Concrete (crushed)	0.00	0.00	0.00	1,499.00	1,499.00
Coolant	0.00	0.00	0.00	0.00	0.00
Cylinders	0.28	0.00	0.00	0.00	0.28
Empty Containers	0.00	0.26	0.18	0.30	0.74
E-Waste -Monitors	6.60	1.50	5.00	1.50	14.60
Fluorescent light tubes	1.83	0.52	0.00	0.43	2.78
Glass Beverage	0.00	0.00	0.00	0.40	0.40
Lead	0.00	0.00	2.19	0.00	2.19
Mercury items	0.00	0.01	0.01	0.01	0.03
Metal drums	0.00	0.00	0.00	0.00	0.00
Oil Filters	0.00	0.13	0.15	0.00	0.28
Oil-Waste	0.76	0.40	0.41	0.42	1.99
Palladium	0.00	0.00	0.01	0.00	0.01
Paper	13.74	18.19	16.20	15.40	63.53
Pipette Boxes	0.00	0.00	0.03	0.00	0.03
Plastic Beverage	0.00	0.00	0.13	0.17	0.30
Resin Bottles	0.75	1.25	0.00	0.75	2.75
Scrap Metal	32.00	16.08	23.32	65.50	136.90
Tires	0.00	0.08	0.00	0.00	0.08
Toner Cartridges	0.15	0.44	0.65	0.50	1.74
Wood	7.10	6.57	4.75	1.81	20.23

Sanitary waste	42.63	39.47	28.09	49.8	159.99
Sanitary waste-green & mixed	12.97	36.33	26.47	4.25	80.02

Appendix C
Interviews

PPOA
CENTRAL RECYCLING FACILITY

INTERVIEWS (5/24/06):

- Craig Taylor, Dave Rabb (Org. 8512)
    - Only waste streams of interest would be soil, concrete, debris. Currently, excess soil is randomly deposited around the site. These soil piles can create maintenance problems, since you can't mow a mound.
    - SNL/CA has a CWM (1505) spec. Taylor/Rabb control the specifications. If recycling center is built, could include this as a specification requirement, which would serve to make it easier to recycle what's in the spec. Doug Vreiling (Org. 8512, 294-1236) owns the Specifications.
    - For D&D jobs, the contracts generally provide the salvage rights to the contractor to lower the project costs. But contractors are not required to report the amounts that they might get revenues from recycling. The Recycling Center may not work for the larger projects, but would be appropriate for 8514 projects.
    - Will need to revise the specs to correctly direct the contractors to: use the Recycling Center; have salvage rights and report the amount dispositioned.
    - Small renovation/modification projects are executed by SNL/CA trades people. They are aware that they should recycle scrap metal & scrap wood to the roll-off bins. But it would be good to have a procedure.
    - Roll-offs up on the "hill" are for facilities projects. Disposal at the Vasco Landfill is ~ $33/ton.
    - During the IDT process, P2 tries to catch recycling opportunities and identify that collection containers are needed. Bring service to the job whenever possible. Now, it is not cost effective to have unsophisticated contractors separate and recycle. But, the Recycle Center could help. These contractors could use the facility. It would be easier and could reduce costs.
    - Laurie will try to obtain the disposal costs (per ton or per bin) when contractors have to dispose of small demo debris.
    - They can help us "sell" the idea of a Recycling Center. Dave will socialize the idea in Facilities. Come up with several sites (outside Post 15, near Bldg.966) and develop pros and cons.
    - Note that all construction contractor traffic enters and leaves via Post 15
    - Site requirements:
        - Some power (for baler, for scale)
        - Trailer/cover for carpet/ceiling tiles
        - Unmanned office?
    - Asking to add additional floor space may be a problem. Transportainers are better, since they do not count as "space."
    - Need to make the case for: "Why do we want to get in this business?" (per Ed Cull Jr.) Also, need to answer the questions: "Why can't we continue to use LLNL?" "Why do we need our own?" "How do we pay for it, both 1st costs and annual operational costs?"

- Gary Weese
    - Duties: Landscape Maintenance, P/T trash truck driver to Vasco landfill, responsible for green waste, certified pesticide applicator, nesting birds, animal disposal, etc.,
    - Green Waste goes to Altamont Landfill. Collected in 30-yd roll-offs. Gary pretty sure green waste is being chipped, shredded & composted at Altamont.
    - Cost of bark is $59/yd, now buying redwood bark at $29/yd
    - Need to determine cost of green waste disposal.
    - Now using mulching blades for the self-propelled Ex-Mark (sp?) mower. There are a total of 6 mowers. This will cut down on green waste, but, because of the maturity of the tree-thinning program (60 yd/month) [what else in this sentence???]
    - Gary forecasts about 2-3 trees/year will be removed, resulting in ~90 yds/mo of additional green waste. Most of tree cutting occurs from October – March (outside of nesting bird season)
    - $370 to empty each 30 yd bin. At least two per month, about 8 months of the year.
    - Gary stated $480/40 yd rolloff, but how many per month or per year?
    - Laurie said she will try to reconcile the costs (bills/invoices) from Altamont landfill corresponding to the bins delivered since January.
    - Has to spend time on back hoe putting material in the roll-offs. [Action – try to quantify this time, annually - RW]
    - A chipper/shredder would help (Bandit)
    - 50 yd/month in grass clippings (if they weren't mulched). With mulching, grass waste reduced to zero and also reduces the amount of fertilizer (because mulch is a high nitrogen source). Started mulching ?????? (1) Micromulching deck for EX-Mark mower has been ordered, however, there are six mowers total. Micromulching deck cost is $400/deck. (Confirmed by interview with Gerald V.)
    - Fertilizer orders – Univar, Chem Search (Laurie will find out)
    - Mulch reduces need for Round-up. About 50 gallons per year. $110 per gallon. Mulch will reduce need by ¾.
    - Mulch also reduces the need for water.
    - Can store chipper at Maintenance Yard
    - Existing chipper not in use (due to safety concerns) and requires operation from a vehicle equipped with power take-off (PTO).
    - Chipping would save labor in packing, moving, preparation work required to send tree waste to landfill.
    - Material removed from storm drains and collected in the street sweeper are placed with green waste.

- Gerald Vincent (Gary and Fred work for Gerald)
    - Gerald is supervisor of HVAC (except refrigerant recycling)
    - Mike Frisk takes care of refrigerants of 5 lbs or more.
    - HVAC components demo'd become scrap metal.
    - Bldg 963 Compound includes maintenance shop, welding shop, etc. Bldg 962 is mechanics shop. 962-1 is bike maint. shop.

- Four scrap metal hoppers support the Maintenance Compound. Harold Hernandez picks up the hoppers. Takes about a month or so to fill the 4 hoppers.
- Paul Wilson/Mike Willow involved with ceiling tile projects. All year long, may generate only about 10 yds of ceiling tile.
- Furniture is a big recycling opportunity. Randy Herschberger deals with furniture and chairs (broken, discontinued). Chairs are a problem for recyclers and are currently being placed in trash. Flipper door shelves have different metals.
- Gerald used to work for Apple Computer and they used to disassemble chairs and furniture for recycle. Golden State Services (part of United Van Lines) used to do the Apple work, which is now done by Lindsey's Office Furniture.
- Would like mulching blades for each mower. Have 6 mowers, but only have mulching blades ordered for one mower. Cost is $400 for each mulching blade system.
- LLNL has a chipper that they are willing to give SNL/CA. Need to determine how to get it over.
- Leaves go into the field. Storm drain waste goes into the field. The field has a limited capacity.
- Lamps: Send off 600-1000 lamps every other month. Could look at group re-lamping; lighting retrofits in association with that. Danny Dominguez provides guidance, presently, for de-lamping and re-lamping approach.
- Energy Team: Janet, Gary Shamber, Dave Rabb, Craig Taylor
- Need to talk to 8514 (Structural Services) staff that are actually managing in-house modifications, i.e., interview Dave Dycus

- Fred Richards (Vehicle & Heavy Equipment Manager)
  - Handles following (Recycling opportunities): oil, oil filters, oily rags, aerosol cans (transitioning to Sure Shot containers), kitty litter (spill clean-up), large vehicle batteries, antifreeze, various pieces of equipment
  - Fred was previously involved in the PPOA for the Maintenance Engineering Dept.
  - Has "dump-and-run" occurring at his shop. [more details on this?]
  - Take oil out of vacuum pumps and other equipment, but that may change (because of new appliance regulations)
  - Someone else (Toyota Material Handler) services the back hoes, fork lifts and other heavy equipment. They provide all fluids except the oil. The oil stays here and is dispositioned here.
  - Separate oil, oil filters, hydraulic fluids, antifreeze gets separated into 55 gallon drums. When full goes to HWF.
  - (1) 55 gallon drum of filters every 6 months, [possible use for oil filter spinner].
  - Shed has 6 dispensing containers (hydraulic fluids and oils) filled from 55 gallon drums (delivered by supplier). Supplier takes drums back.
  - Trash Run. Every morning at 5:00 empties cans. Takes about a week and a half to fill truck. Take to Vasco landfill. (Weighs in and out and ultimately reported to P2 - Laurie) Trash has to be covered at landfill before returning to the site.
  - If equipment has refrigerants (less than 5 pounds), they drain the equipment.

- Trash that could be diverted to recycle: Cardboard boxes, Styrofoam (blocks and packing peanuts) [OPPORTUNITY – to reuse at Shipping and Receiving], binders [opportunity for binder re-use program?], metal shavings (perhaps floor sweepings from machine shops), conduit (occasionally), wood, even tools, bolts.
- When remodels occur, both trades and contractors use on-site dumpsters for disposal of all material (metal, sheetrock, insulation). Opportunity to collect C&D waste?
- Regular trash is in plastic bags and is difficult to determine the recycling potential. 30-40 dumpsters every morning.
- Empty containers (mostly plastic, but some glass, all under 5 gallons, cannot be acutely hazardous material, must meet CA definition of empty) are separately collected (by Michael & Pam?) and recycled at the landfill [delivered by Sandia?]. Two 4-yard bins are emptied about once a quarter.
- Tried to implement rag recycling in Fred's area, but it didn't work out well (Ask Dwight)
- Tried bio-based hydraulic fluid, but did not like it. Seems to accumulate in bottom of equipment as sludge.
- [Need to re-investigate getting new solvent washer]
- TIRES: Generate a lot of cart tires, bicycle tires and a few large tires (i.e., from dump truck). Laurie has identified a good source for tire recycling.
- Approximately 250 bikes on site (used to be 400). There is a bicycle maintenance shop that works well (under Dwight Soria supervision).
- Boom Truck on site w/ 2-ton crane. Former GSA vehicle. Need to disposition, but there are issues.

- Doug Garceau (P2)
  - Collects wood, cardboard, glass, plastic, aluminum cans. Performs equipment cleanouts.
  - Sometimes sorts/cleans recyclables
  - Places bins on site.
  - MO59 and Bldg 925 are only ones putting the right paper in the bins.
  - Much cardboard is in trash. [same observation by Fred]
  - Bldg 963 has much contamination in paper.
  - Bldg 963 – waste wood hopper collects dimensional lumber – could be chipped.
  - Potential for compaction of wood, plastic, aluminum cans using backhoe
  - Paper collection by escorting Shred-It truck around site. [Notes from Laurie and Janet: Charge in FY05 was ~ $64K, and that includes the 80 bins around the site. A replacement cost if necessary would be ~ $80/bin. The cost includes the pick-up and delivery to their site, where the shredded (single) paper is baled.]
  - All cardboard containers belong to Waste Management (there are a total of 20). No charge.
  - Are HVAC air filters recyclable?
  - Thinks facility needs to be on the outside of the area. Should be larger than the fenced-in area being considered as option.

Ralph's notes after interview with Doug: Need a 40' long weight scale and a place for waste/recycling documentation.

- Dwight Soria (963-1 and 963-2 are warehouse buildings)
    - Responsible for tires, oil, bicycles, carpet tiles, ceiling tiles, cardboard and wood pallets. They and janitorial staff knock down boxes and place them in recycling containers.
    - Owns tool crib, orders all chemicals for trades (e.g., WD-40).
    - Dwight was previously involved in the PPOA for the Maintenance Engineering Dept.
    - SDR for bicycle maintenance contract.
    - Store all things that Facilities will need for a job (e.g., paint, wallboard, ceiling tiles). Stages it and takes back the excess and accumulate it (in 963-1 & 963-3). Dwight provides Laurie the quantities on CPG items.
        - Uses MAXIMO database. Engineers can use the resource to determine what is in inventory, but many do not use this function. There is currently not a mechanism to make the excess materials available as a first choice for the next similar project.
        - Dwight pulses project managers periodically (annually) as to whether they still want the material. If not, he disposes it. [Albuquerque takes excess back by treating it as new, incoming inventory (to be used by other projects)].
        - Al Ducharme tries to order standard materials.
    - Need a process map for a typical small project (ordering, staging, returning excess, etc.). Create and show to Dwight.
    - Call for roll-off and dumpsters to be picked up and emptied. Coordinate roll-off removal/empty w/ LLNL or Landfill.
    - SNL/CA owns trash dumpsters and metal hoppers and nothing else. No roll-offs.
    - Grainger is the pass through supplier for the A-8 minority contractor. Can get most things delivered in one day.
    - Trying to change ceiling tile process, so that Dwight only gets the tiles that can be recycled. Doug G. will take the ones that can't be used. However, Site architect (Ducharme) wants to keep all. [Potential opportunity to partner w/ LLNL for ceiling tile collection, storing ceiling tiles in transportainers at recycling center]
    - Prefers to process material directly from the job site (i.e., for D&D jobs), rather than bringing the material to the Warehouse where extra handling is required.
    - Warehouse stages fluorescent lamps for replacement. Replaced lamps are put back in boxes and staged in a trailer for disposal/recycle (Laurie manages the contract).

- Nathan Humphreys (Custodial, via Gerald Vincent e-mail)
    - What works: reducing the overall campus trash and increasing awareness of recycling. Increased customer participation will enable custodians to focus on their baseline services.
    - What does not work: too many frequent and drastic changes to the program that would put the custodians in a defensive posture with customers.
    - How can we make your job easier: Educating customers about the recycling program and its importance. The new process we heard about in the custodial meeting this morning sounds like it will be a great help.
    - How can we recycle more: The empty container recycling program that we're rolling out will generate a considerable amount. Based on numbers from 2003-2005, the custodial group estimates it will generate 1055 empty containers per year.
    - If a recycling center is built, any operations on-site that could be eliminated? Too premature to answer.

- Lynn McClellan (Manager for Reclamation/Reapplication)
    - Don't have an MOA (MOU) in place with Lawrence now. Looking to renew. LLNL, due to quantity, has better access to recyclers, especially those with safe operations.
    - As part of agreement to take metal, they also take furniture and monitors and computer equipment.
    - When we were managing our own scrap metal, because of the small volume, we weren't getting the big players. There were safety issues with the small recyclers and liability issues (rad-contaminated metal was sent off-site). Estimates from scrap metal revenues were ~ $2500/yr.
    - New CA law on appliances disposal (re: CFC's, etc.) has recently put the hammer down on all other equipment disposal. LLNL is in the process of becoming an appliance recycler, but not taking them now. This has held up renewing the MOU with Lawrence.
    - Janet will provide language on this new CA regulation.
    - It is possible that metals could be separated to provide more value. TAG (test assembly group) area and the machine shop are candidates for metal separation.
    - Student cleans computers, determines if they are usable, loads new software and reapplies it. If the computer is not good, then the hard drive is removed and sent to Lawrence.
    - Albuquerque – contract with company in San Jose to take hard drives (action – Talk to Sam about SNL/NM disposition of hard drives)
    - Has responsibility for precious metals bank. Participate in the DOE Precious metals program. (Laurie works with Tanja)
    - SNL/CA gives empty toner cartridges to Arista – no cost, but do not get a break. Buy new or remanufactured cartridges from Staples.
    - Do try to reuse pallets. If not, they go to landfill as wood waste. Could investigate (action)
    - Jeff Manchester was previous reclamation manager when SNL/CA was sending their metals off-site (before Lawrence began taking the material).

- Perhaps don't have enough scrap hoppers (4-yd tilt hoppers owned by Sandia). Need to ask Harold Hernandez how many there are (action). Harold coordinates emptying the scrap metal hoppers into the LLNL scrap metal roll-off container. Action - Laurie will get an estimate from Harold on hours/month on this activity, including delivering them to pick-up locations.
- 4-yd tilt hoppers are dumped into 40-yd roll-off at Sandia yard. About once/mo., LLNL picks up the roll-off. On special occasions, other scrap metal is picked up and delivered by Sandia to LLNL on flat-bed. Quantities are reported by reclamation to P2 in this instance

- Paula Painter (Procurement)
  - Republic Services (Vasco) takes trash.
  - Livermore Dublin (Altamont) is run by Waste Management. They take green waste, wood, concrete, empty containers, cardboard.
  - Livermore Dublin (Altamont) owns the roll-offs.
  - Dirt stays on site.
  - Area recycling resource guide: Alameda County Recycling Guide
  - Republic Services (Vasco) ~$10K/yr
  - Livermore Dublin (Altamont) contract is $18K/yr. 5-yr average: $17K/yr
  - "Metallic Waste" is refrigerant items < 5 lbs., $1,800/yr to Vasco
  - Chairs are going to Livermore Dublin (Altamont)

Appendix D
Ranking of Top Recyclables to PPOA Goals

	Scrap Metal	Landscaping Debris	Office Paper	Wood	Cardboard	Concrete/ Asphalt	Computer Equipment	Plastics, other empty containers	Furniture
Improve efficiency of recycling operations*	1-2	3	1-2	1	2	0	2	1	0-1
Reduce costs	2	3	3	2	1	1	1	2 ++	1
Increase revenues	3	0	1	0	2	0	0**	0	0
Increase in recycling streams or % recycling	1	2	1	2	2	1	1-2	0-1	1
Operate independently of LLNL	2	0	0	0	0	0	2 +	0	1
Total	9-10	8	6-7	5	7	2	6-7	3-4	4

0 = no potential
1 = low potential
2 = medium potential
3 = high potential

* Metrics
Frequency of handling waste stream
Number of containers/bins needed
Ease of reporting/documentation

* Definition (for consideration)
Lowering associated costs for the same recycling levels; increasing revenues for the same recycling levels

** Call ECS (Santa Clara, CA)
+ LLNL already doing FEC
++ Doug to ask Laurie to truly ascertain the potential to reduce costs for plastics collection

Appendix E
Recycle Center Location Pros and Cons

Possible Locations for Recycling Center

Location	Pros	Cons
Site A		
East of Thunderbird Lane 22,400 SF (80'x280')	• Size available is adequate, could accommodate scale • Easy access for trucks • Paved • Noise and dust will affect less site personnel • Logistics adequate	• No utilities • No fencing • Potential turf war due to use as overflow parking for large site events • Aesthetics
Site B		
Contractor Yard Adjacent to Reclamation 24,850 SF (105'x210' plus 40'x70' @SE)	• Near utilities • Closest to Reclamation • Closer for P2 personnel to check operation • Size is adequate, & largest site available • could accommodate scale • Logistics adequate	• Relocation of contractor now using site • Relocation of trailers (probably a non-issue) • Tighter turn for truck drivers • Needs to be repaved • May have to include part of parking lot • May have to add fencing if expansion to parking lot is needed • Noise and dust could affect site personnel depending on when pickups occurred • Near arroyo (only an issue if the area needs to grow)
Site C		
Area next to the Fire Yard (south/southeast of Building 968)	• Size available is adequate, could accommodate scale • Easy access for trucks • Near utilities • Noise and dust will affect less site personnel • Convenient to scrap metal collection	• No fencing • No paving • Likely turf war (already serves as reclamation yard)
Site D		
South of B966, near Maintenance Yard 11,020 SF (85' x 156' minus 40'x56' @ SE)	• Near utilities • Paved • Fencing not needed	• Smallest of 4 possible sites – could be adequate for 1 or 2 recycle streams • No room for expansion • Aesthetics • Tighter turn for trucks • Noise and dust could affect site personnel depending on when pickups occurred • Significant truck traffic around Area 8 • Poorest logistic location of all sites i.e., other sites are "on the way offsite"

Appendix F
Cardboard Recycling
Guidance for Sandia Construction Contractors

Cardboard

Construction & Demolition Recycle Center
Guidance for Sandia Construction Contractors

Cardboard is a commonly discarded construction waste material for which recycling capabilities exist at the Construction & Demolition Recycle Center. The following guidance was developed to assist Sandia construction contractors in utilizing the Center.

What "Cardboard" Waste can be Recycled at the C&D Recycle Center?
The most common form of cardboard waste at construction sites is boxes used for packaging and shipping items/materials. Cardboard can be visually identified by its construction, which consists of two flat sheets on the top and bottom, and a wavy "corrugated" or fluted strip running through the center.

Paperboard (flat, pressed, stiff paper used in cereal boxes, for example) is a material that is often mistaken as cardboard. Paperboard is **NOT** cardboard and, therefore, should not be placed in the Center's cardboard recycling container.

What are Contaminants in Cardboard?
The following materials/items are commonly mixed with cardboard and must be removed prior to placement in the Center's cardboard recycling container:

- Packing materials such as paper, plastic, bubble wrap, and Styrofoam.
- Paperboard (see definition of paperboard above).
- Any non-cardboard materials such as metal, wood, plastic, glass, or other general trash (soda cans or plastic bottles, food waste, etc.).

What are Acceptable Quantities of Contaminants in Cardboard?
In general, every attempt must be made to remove all contamination from cardboard prior to placement in the Center's cardboard recycling container. However, small amounts of paper or paperboard can be tolerated. If cardboard contains contamination that can't be separated, the contaminated cardboard should be placed in the Center's container labeled for general construction waste.

> *It is critical that cardboard boxes containing other waste material are not placed in the Center's cardboard recycling container. Since non-cardboard waste within cardboard boxes may not be readily visible, cardboard boxes should be flattened prior to placement in the Center's cardboard recycling container.*

NOTE: C&D Recycle Center personnel will be available to provide additional assistance to construction contractors upon arrival at the Center.

Appendix G
Potential Recycling Revenue Evaluation

Potential Scrap Metal Recycling Revenue Assessment

Scrap Metal Recycling Option Summary

This assessment identifies the potential revenue and cost for SNL/CA to recycle scrap metal through an outside commercial scrap metal recycling vendor. This opportunity does not require any operational changes relative to the current procedures for managing scrap metal that is sent to LLNL. The only difference is the roll-off container used to accumulate scrap metal would belong to the commercial scrap metal recycling vendor. The vendor would require escorting for pickups/deliveries.

Potential Commercial Scrap Metal Recyclers

1. Custom Alloy Scrap Sales, Inc. (CASS), located in Oakland, CA (510-893-6476)
2. Sims Metal, Hayward, CA (510-471-6600)

Scrap Metal Recycling Input Data and Assumptions

Annual Data	FY05	FY06
Annual Scrap Metal Recycled (lbs)	314,500	301,180
Assumed Average Load Weight (lbs/load)	12,000	12,000
Approximate # of Loads per year	26	25

NOTE: Metal recycle values include commercial recycling vendor transportation and sorting fees.

Option 1: Assume 10% Non-Ferrous Metals (Based on CASS Quote)

Metal Type	Assumed Composition (% of load)	Component Weight (lbs)	Recycle Value ($/lb)	Component Value ($)
Ferrous				
Ferrous Scrap (HMS)	25.0%	3000	$0.040	$120.00
Ferrous Scrap (Lt Gg/Tin)	65.0%	7800	$0.023	$175.50
Non-Ferrous				
Y/B (Brass)	0.5%	60	$1.680	$100.80
Copper - Bright & Shiny	0.5%	60	$2.780	$166.80
Copper - #1	0.5%	60	$2.680	$160.80
Copper - #2	0.5%	60	$2.530	$151.80
Copper Wire	0.5%	60	$1.760	$105.60
Stainless Steel	1.0%	120	$0.980	$117.60
Aluminum	4.0%	480	$0.750	$360.00
MTLOUT (contaminated non-ferrous)	2.0%	240	$0.740	$177.60
Electric Motors	0.5%	60	$0.150	$9.00
Totals/load	100.0%	12000.00		$1,645.50

Potential FY05 Revenue	$43,125.81
Potential FY06 Revenue	$41,299.31

Option 2: Assume 25% Non-Ferrous Metals (Based on CASS Quote)

Metal Type	Assumed Composition (% of load)	Component Weight (lbs)	Recycle Value ($/lb)	Component Value ($)
Ferrous				
Ferrous Scrap (HMS)	15.0%	1800	$0.040	$72.00
Ferrous Scrap (Lt Gg/Tin)	60.0%	7200	$0.023	$162.00
Non-Ferrous				
Y/B (Brass)	1.5%	180	$1.680	$302.40
Copper - Bright & Shiny	1.5%	180	$2.780	$500.40
Copper - #1	1.5%	180	$2.680	$482.40
Copper - #2	1.5%	180	$2.530	$455.40
Copper Wire	1.5%	180	$1.760	$316.80
Stainless Steel	2.0%	240	$0.980	$235.20
Aluminum	10.0%	1200	$0.750	$900.00
MTLOUT (contaminated non-ferrous)	4.0%	480	$0.740	$355.20
Electric Motors	1.5%	180	$0.150	$27.00
Totals/load	100.0%	12000.00		$3,808.80

Potential FY05 Revenue	$99,822.30
Potential FY06 Revenue	$95,594.53

Heavy Melting Scrap (HMS)
Tin, Light Guage Steel

Potential Cardboard Recycling Revenue Assessment

Cardboard Recycling Options Summary

This assessment identifies the potential revenue and cost for SNL/CA to recycle cardboard
for revenue through an outside commercial cardboard recycling vendor. The options identified would require SNL/CA to procure collection containers to replace those currently provided by Waste Management (WM). One option is to collect and deliver cardboard in a loose form to a commercial cardboard recycling vendor located in Pleasanton, CA. The other option is to collect cardboard at an onsite central location where the material is baled for pickup by a commercial cardboard recycling vendor located in Hayward,
CA.

Potential Commercial Cardboard Recyclers:

1. Recycling & Resource Recovery Systems (RRRS), Pleasanton Transfer Station (925-846-4062)
   Revenue = $0.01/lb (delivered flat, loose)
2. Northern California Paper Recyclers (NCPR), located in Hayward (510-476-1620)
   Revenue = (based on quantity of baled cardboard)
3. Secondary Fibre, located in Hayward (510-487-4995)

Cardboard Recycling Input Data and Assumptions

Annual Data	FY05	FY06
WM Collection Frequency	12	12
Annual Quantity to WM (lbs)	39,000	43,882
Avg Weight per Collection (lbs/load)	3,250	3,657

NOTE: Both revenue options for cardboard involve replacing the current recycling contract with Waste Management (WM). As such, SNL/CA would be required to replace the cardboard collection containers currently provided by WM. Option 1 involves SNL/CA personnel collecting cardboard and delivering to RRRS in Pleasanton. Option 2 involves SNL/CA personnel collecting cardboard and delivering to a designated onsite recycling center for baling using an SNL/CA procured baler. A commercial cardboard recycling vendor (NCPR) would pickup baled cardboard after a sufficient quantity
is accumulated.

Revenue Option 1: Cardboard Delivered to RRRS loose in SNL/CA-owned Trash Truck

Annual Basis	Quantity (lbs)	Refund Value ($/lb)	Annual Revenue ($)
FY05	39,000	$0.01	$390.00
FY06	43,882	$0.01	$438.82

Revenue Option 2: Cardboard Baled and Picked up by NCPR

Annual Basis	FY05 Quantity (tons)	Refund Value ($/ton)	Annual Revenue ($)	
FY05	19.5	$23.00	$448.50	(NCPR pick up, 1 to 4 tons)
	19.5	$46.00	$897.00	(NCPR pick up, 4 to 6 tons)
	19.5	$57.50	$1,121.25	(NCPR pick up, 6 to 10 tons)
	19.5	$69.00	$1,345.50	(NCPR pick up, 10 tons or more)
	19.5	$57.50	$1,121.25	(delivered to NCPR)
***Assume 2 pickups per year @ ~ 10 tons each or $1,345.5 annual revenue!				
FY06	21.9	$23.00	$503.70	(NCPR pick up, 1 to 4 tons)
	21.9	$46.00	$1,007.40	(NCPR pick up, 4 to 6 tons)
	21.9	$57.50	$1,259.25	(NCPR pick up, 6 to 10 tons)
	21.9	$69.00	$1,511.10	(NCPR pick up, 10 tons or more)
	21.9	$57.50	$1,259.25	(delivered to NCPR)
***Assume 2 pickups per year @ ~ 10 tons each or $1,511.1 annual revenue!				

Additional Costs to SNL/CA

Both options require the procurement of collection bins to replace the (20) currently provided by Waste Management. Option 1 requires use of the SNL/CA-owned general refuse truck to perform collection and delivery to the RRES facility in Pleasanton, CA. Option 2 requires the additional procurement of a baler as well as additional staff time to operate the baler.

Option 1 Container Procurement Costs

Container	Size	Number	Cost/bin	Total
3-yd wheeled bin	3-yd	20	$700	$14,000

Option 1 Additional Manpower Costs

Cardboard Collection	4 hrs/month	$21/hr	$84/month	$1008/yr
Container Management	None			
Cardboard Delivery to RRES	2 hrs/month	$21/hr	$42/month	$504/yr
Container Movement Cost Elimination	2 hrs/week	$21/hr	(-$84/month)	(-$1008/yr)

(Refuse truck use costs also incurred, but not included in calculation)

Option 2 Container Procurement Costs

Container	Size	Number	Cost/bin	Total
3-yd wheeled bin	3-yd	20	$700	$14,000

Option 2 Baler Procurement Costs

Vertical Baler, 15 Hp, up to 1000 lb bale	$10,000	(delivered and installed)

Option 2 Additional Manpower Costs

Cardboard Collection Container	None			
Management	None			
Baler O&M	4 hours/month (P2 staff)	$21/hr	$84/month	$1008/yr

First Cost Simple Pay Back Analysis

Option	Equipment ($)	Revenue ($/yr)	Simple Payback (yrs)
Option 1	$14,000.00	$390.00	35.9
Option 2	$24,000.00	$1,345.50	17.8

Potential Wood Pallet Recycling Revenue Assessment

Wood Recycling Options Summary

This assessment identifies the potential revenue and cost for SNL/CA to recycle wood for revenue through an outside commercial wood recycling vendor. Wood waste is currently not a revenue based commodity, except in the form of reusable wood pallets. As a result, this option identified here is based on separating reusable wood pallets from other wood waste for the purpose of collection by a commercial wood pallet recycling vendor. All other wood waste (including broken pallets) would continue to be recycled through Waste Management (WM) as currently practiced by SNL/CA.

Potential Commercial Wood Pallet Recyclers:

1. A&M Pallets, located in Hayward (510-785-5814)

2. Oakland Pallet, located in Oakland (510-278-1291)
   Revenue = ($1.75 - $2.75/pallet) (48"x40" only)
   Revenue = ($1.50/pallet) (appropriate wood-type pallets)
   Charge = $100 for minimum 200 pallets (must be inspected before pickup)
3. Commercial Pallet, located in Oakland (510-632-8519)

Wood Pallet Recycling Input Data and Assumptions:

Annual Data	FY05	FY06
WM Wood Collection Frequency	12	
Annual Wood Quantity to WM (lbs)	109626	44587
Avg Weight per Collection (lbs/load)	9135.5	
# of Pallets/load (1)	114	
# of Pallets/yr (1)	1370	

NOTE (1): Assumes 50% of wood is reusable pallets; 40 lbs/pallet

Revenue Option 1: Collection by Vendor #2 (Oakland Pallet)

Assumption 1: Approximately 50% of pallets are serviceable to the recycling vendor (pallet has value)
Assumption 2: A minimum of 200 pallets are accumulated to ensure a $100 pickup fee criteria.

Material	# of Shipments per year	# of Revenue Pallets/Shipment	# of Non-Revenue Pallets/Shipment	Pallet Revenue/Cost
Shipment of 200 pallets	7	100	100	$175.00
Transport Cost				($100)
			Total Cost/Revenue per year	$525.00

Additional Costs to SNL/CA

Separating reusable pallets for recycling through a commercial pallet recycling vendor will require SNL/CA P2 staff time. However, pallet management is already conducted by P2 staff and this option would not have a significant impact on the man-hours already dedicated to pallet management. Thus, no additional man-hours are considered for this option.

Option Overview: The cost for a single shipment (30-yd roll-off) of wood waste for recycling through Waste Management (WM) is $150. At $100 per shipment of a minimum 200 pallets, the cost would be less than the current Waste Management cost per shipment. Although a net revenue may or may not be possible (depending on the number of "serviceable pallets per load), a reduction in WM costs is very likely
through reductions in the number of collections required for scrap wood.

Potential Electronics Recycling Revenue Assessment

Computer/Electronic Equipment Recycling Options Summary

This assessment identifies the potential revenue and cost for SNL/CA to recycle computer and electronic equipment through an outside commercial electronics recycling vendor. This opportunity requires only minor operational changes relative to the current procedures for managing computer/electronic equipment by disposition through LLNL. The primary difference is that all computer and electronic waste would be palletized for transport by the commercial electronics recycling vendor. This change means that computer and electronic scrap currently placed in the scrap metal container would be palletized in the same manner as the computer monitors. This options eliminates the need for SNL/CA to transport monitors to LLNL.

Potential Commercial Computer/Electronic Equipment Recyclers:

1. Universal Waste Management, Oakland, CA (888-832-9839)
   Revenue = $0 (no cost for pickup of computer/electronic waste)
2. ECS Refining, located in Santa Clara, CA (408-988-4386)
   Revenue = 50% of resale value, and precious metal recovery value

Computer/Electronic Equipment Recycling Input Data and Assumptions:

Annual Data	**FY05**	**FY06**
Number of Loads Sent to LLNL	12	12
Annual Quantity to LLNL (lbs)	26906	32178
Avg Weight per Load (lbs/load)	2242	2682

Assumed Composition of SNL/CA Computer/Electronic Equipment

Composition (Assumed)	Fraction (Assumed)	Component Weight (lbs)
Monitors	50.0%	13,453.00
Electronic Scrap	22.5%	6,053.85
Computer Scrap	22.5%	6,064.61
PC Boards	5.0%	1,345.30

NOTE: The potential to obtain revenue from Vendor #2 is based on uncertainties in resalable equipment and recovery of precious metals. However, at a minimum Vendor #1 enables the recycling of computer and electronics at no cost to SNL/CA. Both vendors eliminate operational costs for transporting monitors to LLNL.

Revenue Option 1: Computer/Electronic Equipment Pickup by Vendor #2 (ECS Refining)

Assumed Cost for Commercial Vendor Services

Material	Fees ($)	Quantity	Total Cost Incurred
Charges			
Pickup Fee (each)	$100.00	6	$600
Processing Fee (monitors)	$0.00	13,453	$0
Processing Fee (remaining material)	$0.25	13,453	$3,363
		Total	$3,963

NOTE: No cost for Commercial Vendor #1 Services.

Assumed Revenue From SNL/CA Computer/Electronic Equipment Recycling

PC Board Recoverables	Assumed Recoverable Fraction	Recovered Quantity (oz)	Revenue Rate ($/oz)	Revenue Value ($)
- Gold	0.44600%	6.000038	$596	$3,576.02
- Silver	1.54000%	20.71762	$12	$248.61
- Palladium	0.09230%	1.2417119	$319	$396.11
- Copper Wire (/lbs)	10.80000%	1,452.92	$0.56	$813.64
			Total	$5,034.38

Potential Annual Revenue for SNL/CA Computer/Electronic Equipment Recycling

Recycling Vendor Cost =	$3,963.25
Potential Revenue Value =	$5,034.38
Total Potential Revenue =	$1,071.13

NOTE: No potential revenue involved with Commercial Vendor #1 Services.

Reduced Manpower Costs				
Eliminated Transport to LLNL	2 hrs/month	$21/hr	(-$42/month)	(-$504/yr)

(Transport truck use costs also eliminated, but not included in calculation)

Potential California CRV (Beverage Container) Revenue Assessment

CRV Recycling Option Summary

This assessment identifies the potential revenue and cost for SNL/CA to recycle glass, plastic, and aluminum cans through the California Redemption Value (CRV) program. This option is currently in place at SNL/CA, with the exception that the current recycling vendor is to be replaced due to inappropriate business practices. Currently, the SNL/CA P2 group is searching for a new vendor that will pickup the CRV materials and provide revenue. This assessment is included only for the purpose of identifying additional revenue sources for the recycling program.

NOTES:

1. Maximum material weights that can be delivery for redemption on any single day is 500 lbs plastic, 500 lbs aluminum cans, and 2,500 lbs glass.
2. Since CRV collection program initiated at SNL/CA in FY06, full year data for collection of CRV material is assumed to be that of a maximum daily delivered quantity.
3. All plastic is assumed to be #1 PETE, the prevalent plastic used for soda and water bottles.
4. The CRV refund rate is based on a per pound basis and commingled loads. Commingled loads contain both CRV and non-CRV containers of the same material.

Revenue Option 1: CRV Pickup by ????

CRV Materials	Quantities (lbs)	Refund Value ($/lb)	Revenue ($)
Plastic (#1 PETE)	500	$0.59	$295.00
Al Cans	500	$1.13	$565.00
Glass	2500	$0.07	$162.50
		Potential Annual Revenue =	$1,022.50

NOTE: The potential revenue list below is based on receiving full redemption value for the materials lists. This value could decrease if a CRV vendor charges for collection. This value could also decrease if SNL/CA provides transportation to the CRV vendor. The transportation logistics are currently unknown pending identification and selection of a CRV vendor.

Appendix H
Recycling Vendor Cost Information

705 Reed Street, Santa Clara, CA 95050
(408) 988-4386

Date: September 15, 2006
Company: Sandia National Laboratories
7011 East Avenue
Livermore, CA 94550
Contact: Ralph Wrons Phone: (505) 844-0601

Statement of Work

The following is a list of services and rates offered to Sandia National Laboratories/Livermore, CA for the removal of obsolete and unwanted electronic equipment.

Recyclable Items:

- Recycling of unwanted California sourced computer monitors: no charge
- Recycling of unwanted California sourced laptops: no charge
- Recycling of unwanted California sourced televisions: no charge
- Recycling of all other obsolete electronic equipment: $0.25/lb.

Payables:

- Some equipment may be of resale value. This can include newer computer equipment as well as laboratory equipment. Some laboratory equipment may be obsolete but contain precious metals, which ECS Refining is able to extract. Any equipment purchased will be credited to the Sandia National Laboratories' account. ECS will reimburse Sandia National Laboratories 50% of the sale price of the resalable equipment after deducting the cost of handling and recycling obsolete equipment.

Transportation:

- Pick-up at Sandia National Laboratories/Livermore: $100.00
- Inside pickup with removal of equipment and palletization: $250.00

A Certificate of Destruction and Recycling will be issued once the processing of the equipment is complete. There is no charge for the Certificate.

Patricia C. Potter
Regional Account Manager
(408) 472-7589 mobile

OAKLAND WAREHOUSE

Hours

Mon - Fri

8am to 4pm

Saturday

9am to 3pm

721 37th Ave.
Oakland, CA 94601

UNIVERSAL WASTE MANAGEMENT INC.

1.888.832.9839

Business Collection

1. One-Hour Business Service:

This type of collection is perfect for businesses, office parks, homeowner associations, and large condominium complexes. Universal Waste Management, Inc. associates show up onsite for one or more hours and take care of everything. A minimum number of monitors and/or computers (30) are required for free service.

Universal Waste Management employees are instructed not to enter your facility (past the loading area). If additional hauling is required, Please notify our office prior to pickup.

This service sounds great for my business. I would like to ask some questions and schedule an appointment.

2. Route Services:

This service is designed for businesses wishing to recycle e-waste on a regular basis (weekly, monthly or quarterly). Universal Waste Management, Inc. will provide a container for regular, on-location service. Call or click below to speak with a route sales specialist.

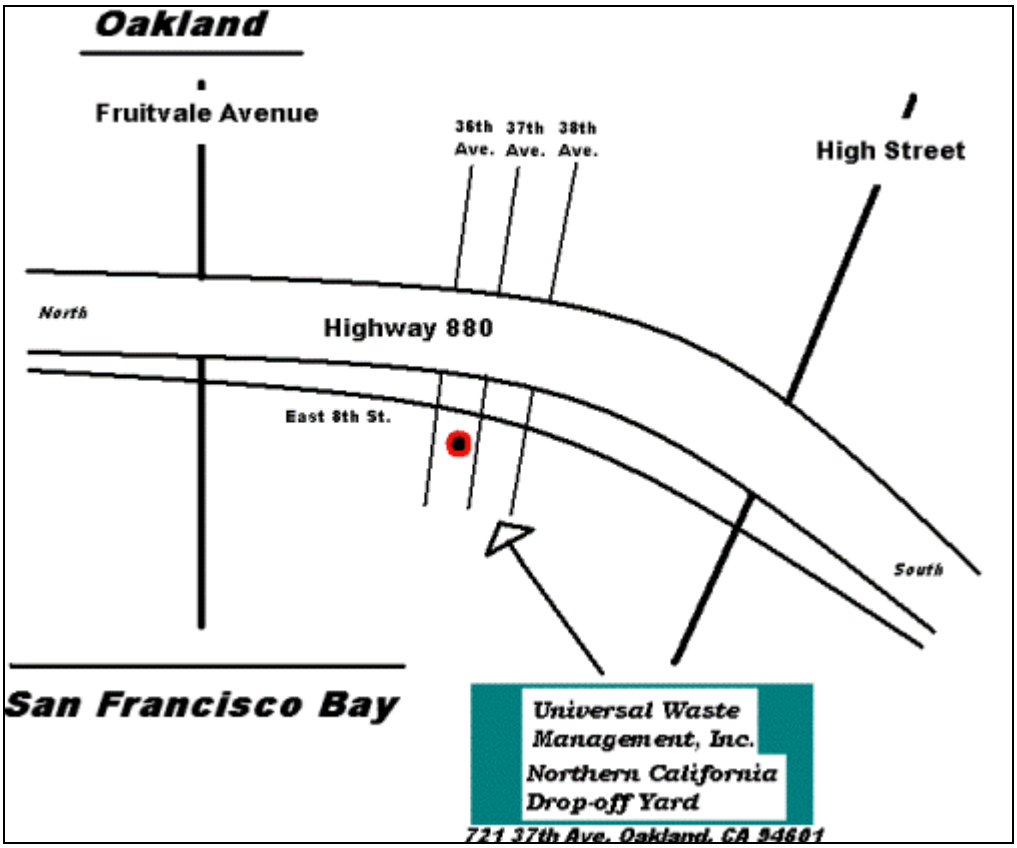
How does this service work and where can I request it?

3. Drop-off:

For smaller quantities of electronic waste, we invite you to drop off at our warehouse Monday through Saturday. Drop off is FREE OF CHARGE and appointments are not necessary.

We are located at:

721 37th Ave.
Oakland, CA 94601
Between the Fruitvale Avenue and High Street exits.
Behind Home Depot.



4. Custom recycling and hauling requests.

UWM can accommodate most recycling and hauling requests. If the specific service your company requires is not listed, please contact us so that we can best meet your needs.

For a general list of materials that UWM collects and recycles, please click here.

Universal Waste Management, Inc.
721 37th Ave.
Oakland, CA 94601
1.888.832.9839
www.unwaste.com

Universal Waste Management, Inc. is a State-Approved E-Waste Collector/Recycler
E-Waste Recycling is a California State-Funded Program

OAKLAND WAREHOUSE

Hours

Mon - Fri

8am to 4pm

Saturday

9am to 3pm

721 37th Ave.
Oakland, CA 94601

UNIVERSAL WASTE MANAGEMENT INC.

1.888.832.9839

Electronic Waste (E-Waste)

What is Electronic Waste (E-Waste)

Electronic Waste (E-Waste)	
Televisions	Monitors
Computer systems	Copy machines
Fax Machines	Printers
MP3 Players	Scanners
Video Game Consoles	Video Games
Cellular Phones (batteries can be included)	Household phones
Stereo Equipment	Miscellaneous wiring
CD's (players and discs)	DVD's (players and discs)
Computer components (i.e. keyboards, mice, internet devices etc.)	
Please keep these items out of our landfill!	
Universal Waste Management, Inc. does not accept household appliances at recycling events.	

Why Recycle Electronic Waste (E-Waste)?

Electronic equipment is made up of a multitude of components which often contain harmful substances, including carcinogens such as lead and arsenic. Therefore, electronic waste should be recycled in order to protect California's air, ground, and water supplies. In recent years, the disposal of e-waste was rather expensive for California residents, costing anywhere from $15 to $35 per recycled item.

Universal Waste Management, Inc. offers environmentally responsible recycling solutions to California residents and businesses for **FREE**. Furthermore, UWM is willing to share the waste recovery payments it receives from the state with various schools and non-profit organizations.

Universal Waste Management, Inc.
721 37th Ave.
Oakland, CA 94601
1.888.832.9839
www.unwaste.com

Universal Waste Management, Inc. is a State-Approved E-Waste Collector/Recycler
E-Waste Recycling is a California State-Funded Program

1820 10th Street, Oakland, CA 94607
Office 510.836.6200 Fax 510.268-1001
www.californiawastesolutions.com

Quoted To:	Sandia National Laboratories, CA Mr. Douglas W. Vetter 7011 East Avenue Livermore, CA 94550 (505) 284-3210

Quote #	1
Date	11/13/06

Description	Container Size	Frequency	Total
OCC	40	1	$300.00
Metal	40	1	$400.00
Wood	40	1	$400.00
EPS #6	50	1	$450.00
Plastic	50	1	$450.00

2 year agreement
Monthly billing

	CWS Services			$2,000.00
	Material Credit			
	Total Per Service (US$)			$2,000.00

Date Authorized: _____ Signature: _____

Acceptance of Proposal
The above specifications, prices and conditions are acceptable. I hereby authorize all work as specified. Payment to be remitted as outlined above.

OAKLAND PALLET CO., INC.

Services

OPC offers the following services for your business:

- **PALLET REPAIR SERVICES**
  Pallets are picked up from your business location. They are then brought to our facility, repaired to your specifications, and returned to you on a scheduled on-going basis or as needed. The cost for this service is a predetermined repair price which includes labor and material.

- **PALLET SALES**
  Pallet sales consist of both remanufactured and new pallets. We carry a large selection of recycled pallets. Upon request we can build to your specification any size pallet, using new or refurbished lumber.

- **PALLET PICK-UP**
  Unwanted pallets can be picked up from your location with or without charges based on serviceability of pallets to Oakland Pallet Co. We do pay for certain sizes, but the pallets must be in repairable condition. Minimum quantities may apply depending on the location of your pick-up site.

Contact & Directions

Sales Rep: Jose Padilla, Javier Padilla, Carlos Padilla

Office hours: 7:00 AM - 5:00 PM

Phone: (510) 278-1291

Fax: (510) 278-2267

Email: opcmail@earthlink.net

Address: 2500 Grant Ave.
San Lorenzo, CA 94580

CASS

Custom Alloy Scrap Sales, Inc.

2730 Peralta Street. Oakland, CA 94607-1707 P.O. Box 24222 .Oakland, CA 94623-1222 Phone: (510) 893-6476 . Fax: (510) 893-2012

SANDIA NATIONAL LABORATORIES
T-70, ROOM 3, MS1037
1515 EUBANK SE
ALBUQUERQUE, NEW
MEXICO 87123

ATTN: DOUG VETTER
FROM: LINDA VOECKS
RE: INTRODUCTION

DEAR DOUG,

WE ARE A FULL SERVICE METAL CONSUMER, BUYER AND PROCESSOR.CASS BEGAN OPERATIONS IN 1970 AND DURING THE LAST 36 YEARS HAVE GROWN INTO ONE OF THE LARGEST PROCESSORS AND EXPORTERS OF COPPER AND ALUMINUM METALS ONTHE WEST COAST.

CASS GUARANTEES A COMMITMENT TO PROVIDE PROMPT AND DEPENDABLE SERVICE. OUR 24 HOUR PHONE-IN SERVICE ENABLES OUR CUSTOMERS TO SCHEDULE NEXT DAY PICK UP AND DELIVERY. IN ADDITION, CASS WILL ENSURE AN EFFICIENT AND PROFITABLE METAL RECYLING PROGRAM FOR YOUR LOCATIONS IN NORTHERN CALIFORNIA. A RANGE OF BOXES, HOPPERS, OR ANY NECESSARY EQUIPMENT IS AVAILABLE TO HANDLE YOUR MATERIAL. CASS CAN PROVIDE A LOCKABLE, ROLL-OF CONTAINER. AND ALSO STACKABLE 4X4'S THAT WILL ALLOW YOU TO STORE 7000/LBS IN A 4X4 FOOT AREA.

WE ARE CERTIFIED BY THE STATE OF CALIFORNIA AS PUBLIC WEIGH MASTERS, AND WILL SUPPLY WEIGHT CERTIFICATES FOR EACH PICKUP, OR IF YOU PREFER, WE WILL ACCEPTS WEIGHTS FROM ANY CERTIFIED PUBLIC SCALE OF YOUR CHOICE BETWEEN SANDIA NATIONAL LABORATORIES AND CASS.

IN THE PAST 36 YEARS WE HAVE ESTABLISHED MANY LONG STANDING BUSINESS RELATIONSHIPS WITH MANY FABRICATORS AND FOUNDRIES, AND WILL BE HAPPY TO SUPPLY REFERRALS IF YOU WISH.

THANK YOU FOR THIS OPPORTUNITY TO INTRODUCE CASS AS THE ALTERNATIVE TO YOUR PRESENT SCRAP DEALER. IF YOU HAVE QUESTIONS, PLEASE CALL ANYTIME.
(OFFICE) 510-893-6476 X 20 (CELL) 925-216-9627

RESPECTFULLY YOURS,

Linda Voecks
CUSTOM ALLOY SCRAP SALES, INC.

CASS

Custom Alloy Scrap Sales, Inc.

2730 Peralta Street • Oakland, CA 94607-1707 • P.O. Box 24222 • Oakland, CA 94623-1222 Phone: (510) 893-6476 • Fax: (510) 893-2012

DOUG,

IT WAS NICE TALKING WITH YOU THIS MORNING. PER OUR CONVERSATION THIS IS AN EXAMPLE OF FREIGHT RATE / CHARGE BELOW. LIVERMORE DISTANCE ROUND TRIP 3 HOURS TO EXCHANGE ROLL-OFF

EXAMPLE

3 HOURS @ $85,.00 =$255.00
APPROX. 15,000/LBS
MATERIAL $255.00 ÷
15,000/LBS = $.02

MARKET VALUE FOR CAST ALUMINUM $.77/LB MINUS THE FREIGHT RATE =$.75/LB

From: Linda Voecks [mailto:linda@customalloy.com]
Sent: Monday, November 20, 2006 4:57 PM
To: Vetter, Douglas
Subject: RE: Another Question

Doug,

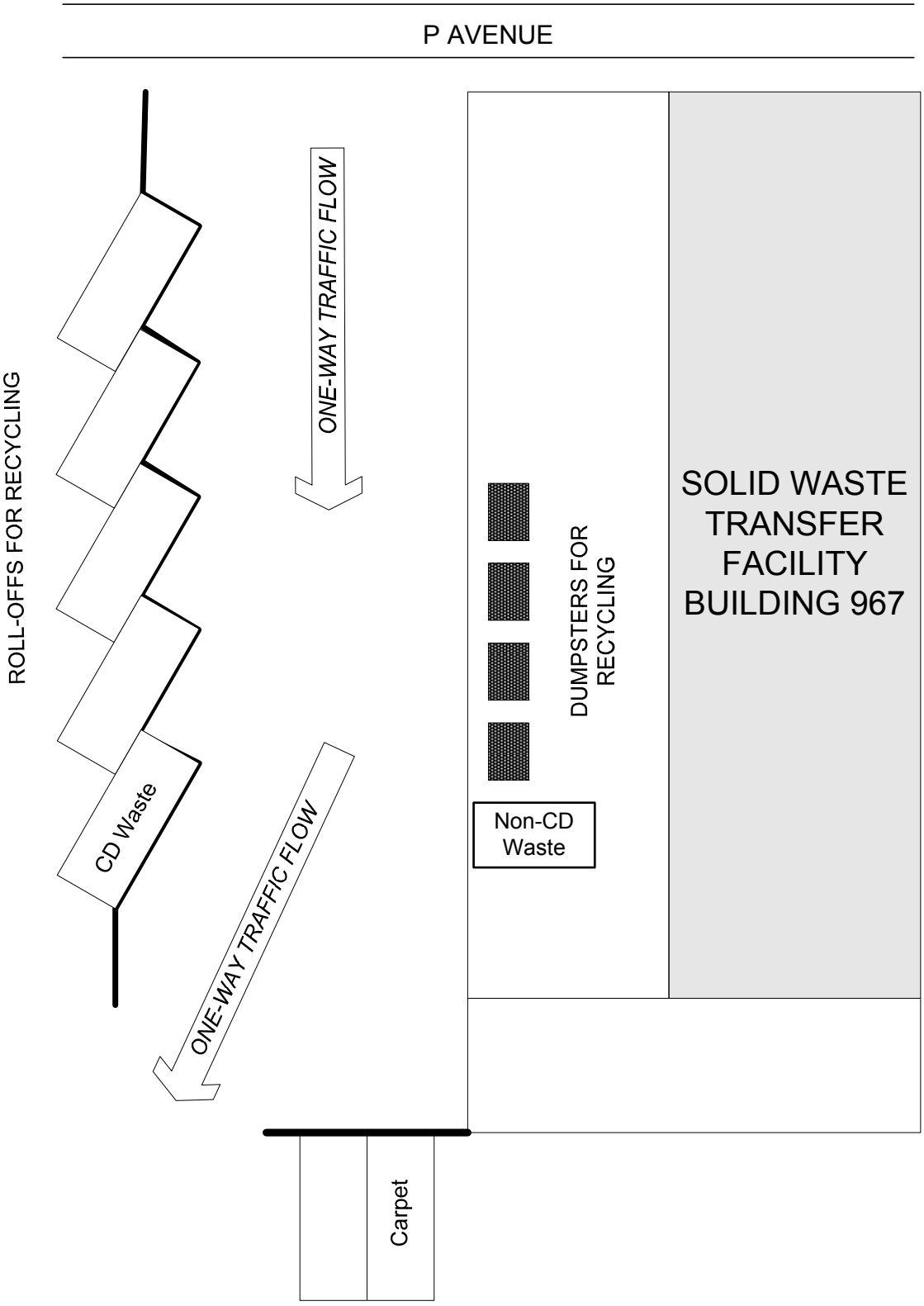
Sorry for the delay. I was out of the office this morning.
Today's Price 11/20/06
Non Ferrous
Y/B $1.70
Bright & Shiny Copper $2.80
#1 Copper $2.70
#2 Copper $2.55
Stainless Steel $1.00
MTLOUT $.76 (Non- Ferrous with contamination, rubber, Iron, plastic) Metal will have a recovery and paid on the percentage at the metal out price.
Copper Wire is also paid on the percentage of Copper content. Formula: $2.55 #2 copper X 70% copper content equals $1.78 per/ Lb.

I would take the best care of Sandia and follow each step from pick – up to being paid prompt.
I Hope I will get the opportunity to give you great service.

Steel prices
Tin, Light steel $85.00 NT (2000 /lb)
HMS #1 and 2 prepared under 5' $120.00 NT

Linda Voecks
Custom Alloy Scrap Sales
Purchase Agent
Phone: (510) 893-6476
Fax: (510) 893-2012
Mobile: (925) 216-9627

Appendix I
SNL/NM C&D Recycle Center Dimension Analysis



SNL/NM C&D Recycle Center

Recycling Center Site Dimension Assessment

As a means to assess the area requirements of a recycling center for the SNL/CA site, the area established for the SNL/NM C&D Recycling Center is described. While the SNL/CA recycling center under consideration would not be limited to C&D waste types, the NM Recycling Center is representative of space needed to accommodate a number of large roll-off containers as well as truck access to manage those containers.

- The NM Recycling Center is approximately 300 ft in length and 150 ft wide. This provides sufficient space for one-way traffic through the center of the facility for material drop-off and one-way truck access on the west side of the facility for roll-off container management. This area provides sufficient space for 5 to 7 roll-off containers, a number of smaller hoppers, as well as minor storage space for bulk materials such as palletized ceiling tiles.

- The NM Recycling Center has one-way traffic flow because return or exit traffic is accommodated by the Solid Waste Transfer Facility (SWTF) yard. Therefore, it is assumed that the SNL/CA recycling center would require space for a return or exit path for trucks. This would add 25 ft in width to the area of the NM Recycling Center.

- The NM Recycling Center has access to a truck scale that is associated with the SWTF. The spatial requirements for a truck scale would require additional space, but could be integrated into the exit pathway, requiring an additional 15' width. A small enclosure (or shack) for housing the scale readout monitor, a printer, etc. would require minimal space and would not likely add to the overall spatial requirements.

The space needs can be summarized as follows:

1. NM Recycle Center = 300ft x 150ft
2. Additional Exit Pathway = 300ft x 25ft
3. Optional Truck Scale = 150ft x 15 ft

Other Design Considerations, Assumptions, Criteria

- Turning Radius for semi-truck ~ 55 ft
- Turning Radius for Standard Trash Truck ~ 35-45 ft
- Turning Radius for Roll-Off Truck ~ 40-45 ft
- Roll-Off Container Dimensions ~ 20 ft long by 8 ft wide by 4-8 ft high
- Roll-Off Container Loading Height Clearance ~ 20 ft above container
- Roll-Off Container Straight Loading Distance ~ 60-65 ft
- Space for operating a small baler or compactor 30 ft .long by 10 ft wide by 8 ft high

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